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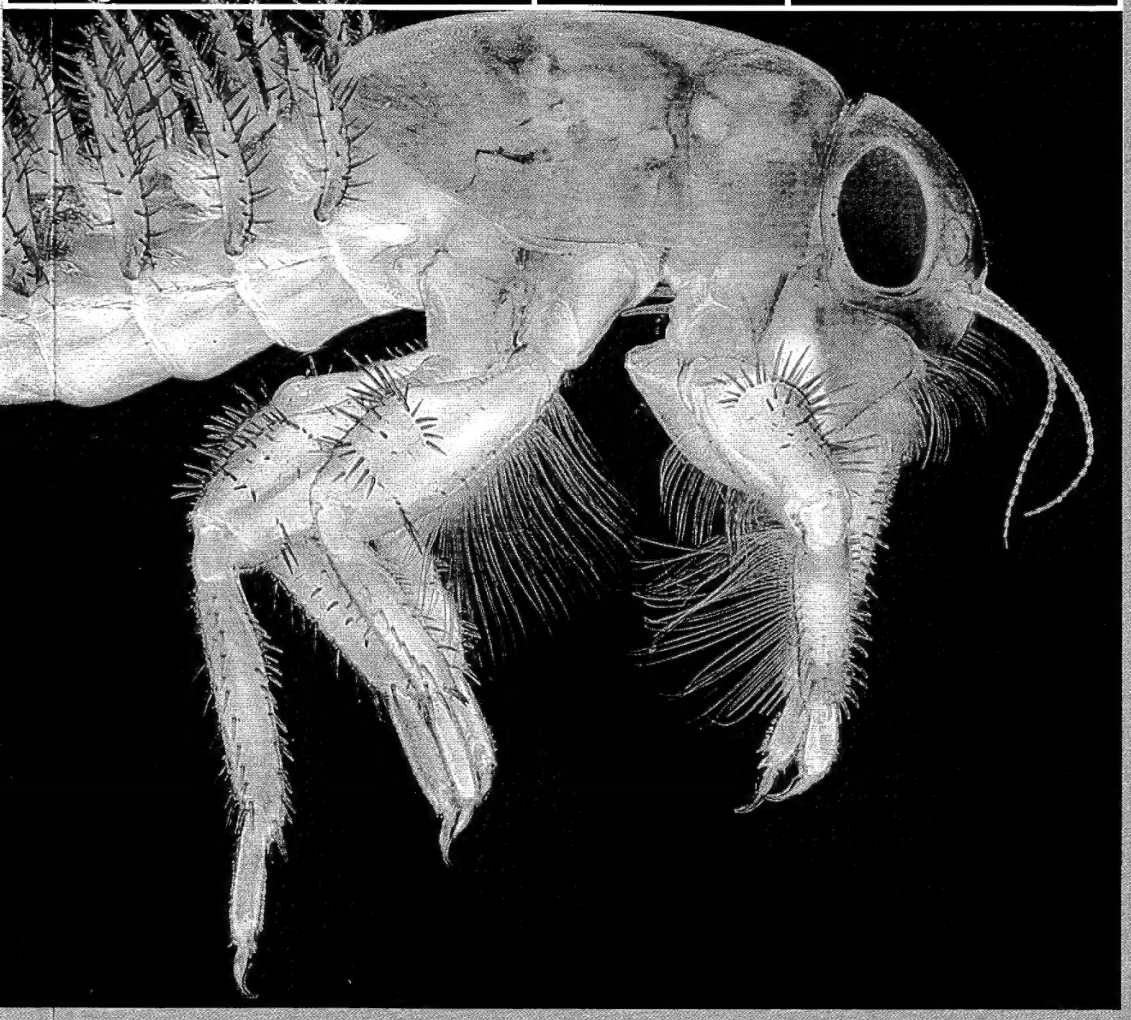

STUTTGARTER BEITRÄGE ZUR NATURKUNDE

A Biologie

Terrestrial isopods of Greece ■ Accessory gills in mayflies ■ Neotropical Cicadellinae ■ Tenebrionidae from Borneo ■ Host catalogue for the Italian Tachinidae ■ Deepwater dragonets from Australia ■ Skull identification of waterfowl ■ Fertile *Lunularia cruciata*

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The terrestrial isopods (Isopoda: Oniscidea) of Greece. 26th contribution: The genus *Armadillidium* (Armadillidiidae) in the province Epirus[1]

Helmut Schmalfuss

Abstract

Based on the revision of the literature, the reinvestigation of type material and the investigation of new collections, 14 species of *Armadillidium* are reported from the province Epirus (= Ípiros) on the northwestern mainland of Greece. Six species were treated in previous contributions of this series. The diagnostic characters of the eight remaining species are described and illustrated, mostly by SEM-photographs, and the Greek records of these species are mapped.

K e y w o r d s : Isopoda, Oniscidea, *Armadillidium*, Greece, Epirus.

Zusammenfassung

Die Untersuchung neuer Aufsammlungen, die Durchsicht der Literatur und die Nachuntersuchung von Typenmaterial ergaben 14 *Armadillidium*-Arten für die Provinz Epirus (= Ípiros) auf dem nordwestlichen griechischen Festland. Sechs Arten wurden in vorangehenden Beiträgen dieser Serie behandelt. Die diagnostischen Merkmale der übrigen acht Arten werden beschrieben und illustriert, meist mit Hilfe von REM-Aufnahmen, und die griechischen Nachweise dieser Arten werden kartiert.

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1 Introduction

In the first part of this new revision of the Greek species of *Armadillidium* (Schmalfuss 2006a) the 18 species from the Peloponnese were treated. The second part contains the 13 species living on the Aegean islands (Schmalfuss 2006b). The third part is dedicated to the 14 species of the northern Greek mainland, comprising the provinces of Macedonia and Thrace (Schmalfuss 2008). In the present fourth part the species from the province Epirus (= Ípiros) on the northwestern mainland are treated (map Fig. 1). In contrast to the provinces of Macedonia and Thrace the material investigated from the province Epirus did not contain any undescribed species. Verhoeff (1902, 1907) and Strouhal (1956) have described a number of *Armadillidium* species from Epirus, based on extensive surveys of this region.

[1] 25th contribution see Stuttgarter Beiträge zur Naturkunde A, Neue Serie 1: 153–201 (2008).

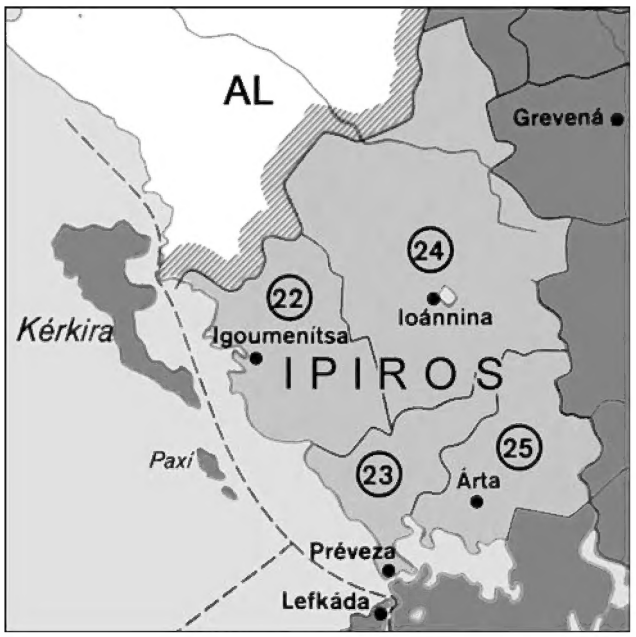

Fig. 1. Map of the treated area, the western Greek province Epirus (= Ípiros). – The numbers indicate the political prefectures (nomoí) which are used to localize the collecting data: 22 = Thesprotía, 23 = Préveza, 24 = Ioánnina, 25 = Árta.

In these four publications 43 species of *Armadillidium* are considered as valid and described in detail. Two more papers are planned to cover all regions of Greece:

– The Ionian islands, with a preliminary number of 20 species, nine of which were not treated in previous parts;

– The central Greek mainland including the provinces of Thessalía, Stereá Elláda and Atikí, with a preliminary number of 15 species, 7 of which were not treated in previous parts.

This adds up to a preliminary number of 59 species of *Armadillidium* for all of Greece. A final summarizing discussion of all Greek species of the genus will be given after the publication of the two parts mentioned above.

Abbreviations

A.	*Armadillidium*
AL	Albania
ex.	example(s), specimen(s)
BMNH	British Museum of Natural History London
GR	Greece
ZMHB	Museum für Naturkunde Berlin
NMW	Naturhistorisches Museum Wien (Vienna)
SMNS	Staatliches Museum für Naturkunde Stuttgart

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The following persons have donated or loaned isopod material used in this revision: Dr. M. Baehr (Munich/Germany), D. Bartsch (SMNS), Dr. P. Dworschak (NMW), Dr. J. Gruber (NMW), Dr. B. Hauser (Geneva/Switzerland), Dr. J. Kontschán (Budapest/Hungary), Prof. Dr. W. Kühnelt † (Vienna/Austria), Dr. H. Malicky (Lunz am See/Austria), Dr. G. Osella (L'Aquila/Italy), Dr. W. Schawaller (SMNS), J. Schönfeld (Westum/Germany), Dr. S. Sfenthourakis (Pátra/Greece), and Dr. K. Thaler † (Innsbruck/Austria).

Dr. K. Wolf-Schwenninger and S. Leidenroth (both SMNS) operated the scanning electron microscope, and J. Reibnitz and Dr. H.-P. Tschorsnig (both SMNS) edited the SEM-photographs and the maps.

Dr. S. Sfenthourakis (Pátra/Greece) and Dr. S. Taiti (Firenze/Italy) reviewed the present paper.

To all of them I wish to express my sincere thanks.

2 Methods

The material used for the SEM-preparations was, if not otherwise stated, air-dried. The mounted material was coated with a 20 nm Au/Pd layer and examined with an ISI-SS40 scanning electron microscope at 10 KV. Digital photographs were directly acquired by using DISS 5 (point electronic).

3 The genus *Armadillidium* in the Epirus

3.1 *Armadillidium albanicum* Verhoeff, 1901 (Figs. 2–11, map Fig. 12)

Literature records

Verhoeff 1901a: 37 (GR, "Korfu" = Ionian island Kérkira; AL, "Aulona" = Vlorë); Verhoeff 1907a: 468; Strouhal 1927: 15 (island Kérkira); Strouhal 1936: 92, fig. 13 (island Kérkira); Strouhal 1937a: 128 (island Kérkira); Strouhal 1937b: 233; Strouhal 1966: 293; Arcangeli 1952: 8 (AL, "sorgente Senufer" near Vlorë (= Valona); Schmalfuss 1981: 277, figs. 1–7.

Material examined

Greece: 1 ex., Ionian island Kérkira, Kavalóvuno near Khlomós, leg. Mahnert, 11.IV.1972 (SMNS 2173). – 2 ex., northwestern mainland, district Ioánnina, Votonósi, 700 m, leg. Kontschán, 13.V.2006 (SMNS 1487).

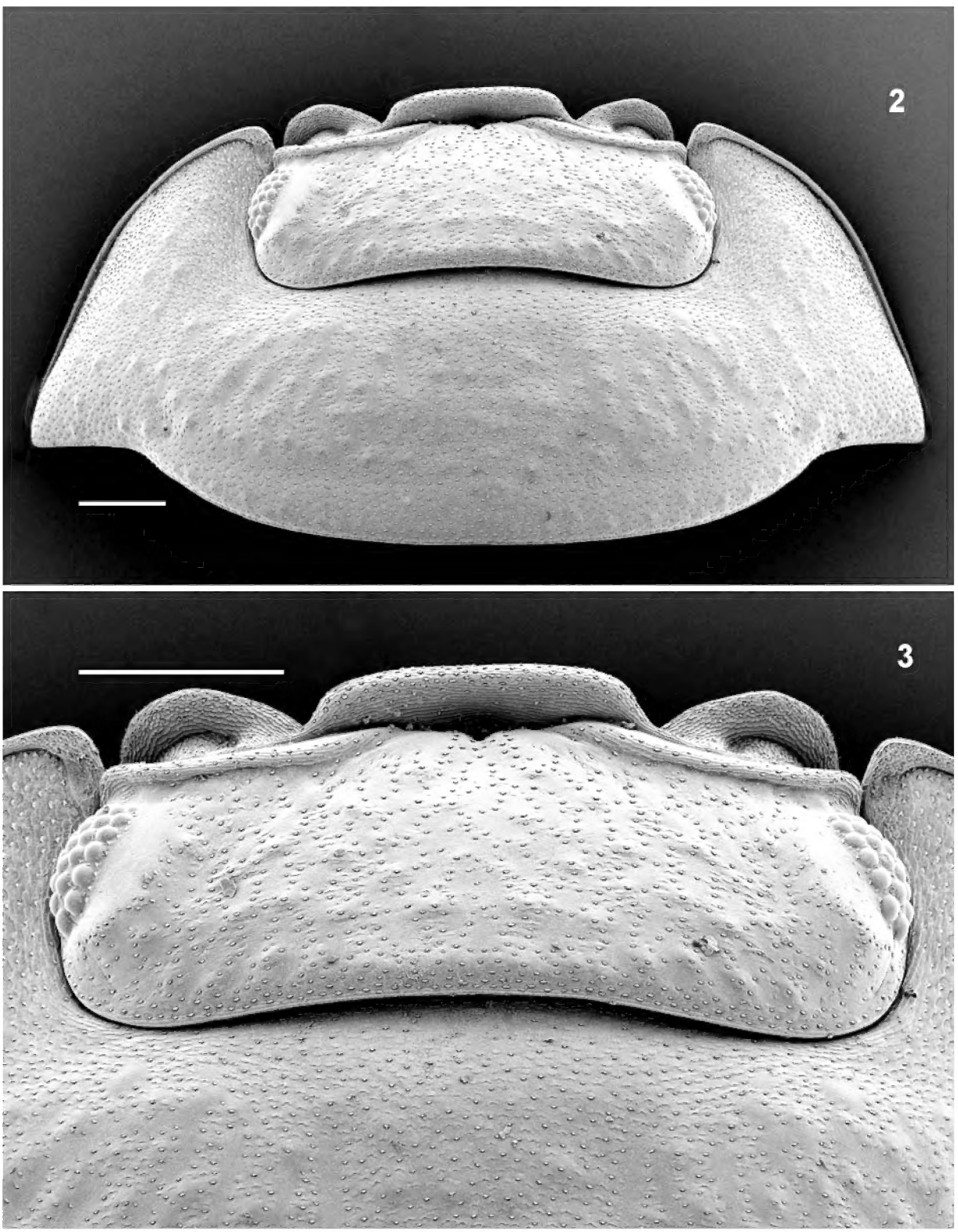
Diagnostic characters

Maximum dimensions: 19 × 10 mm.

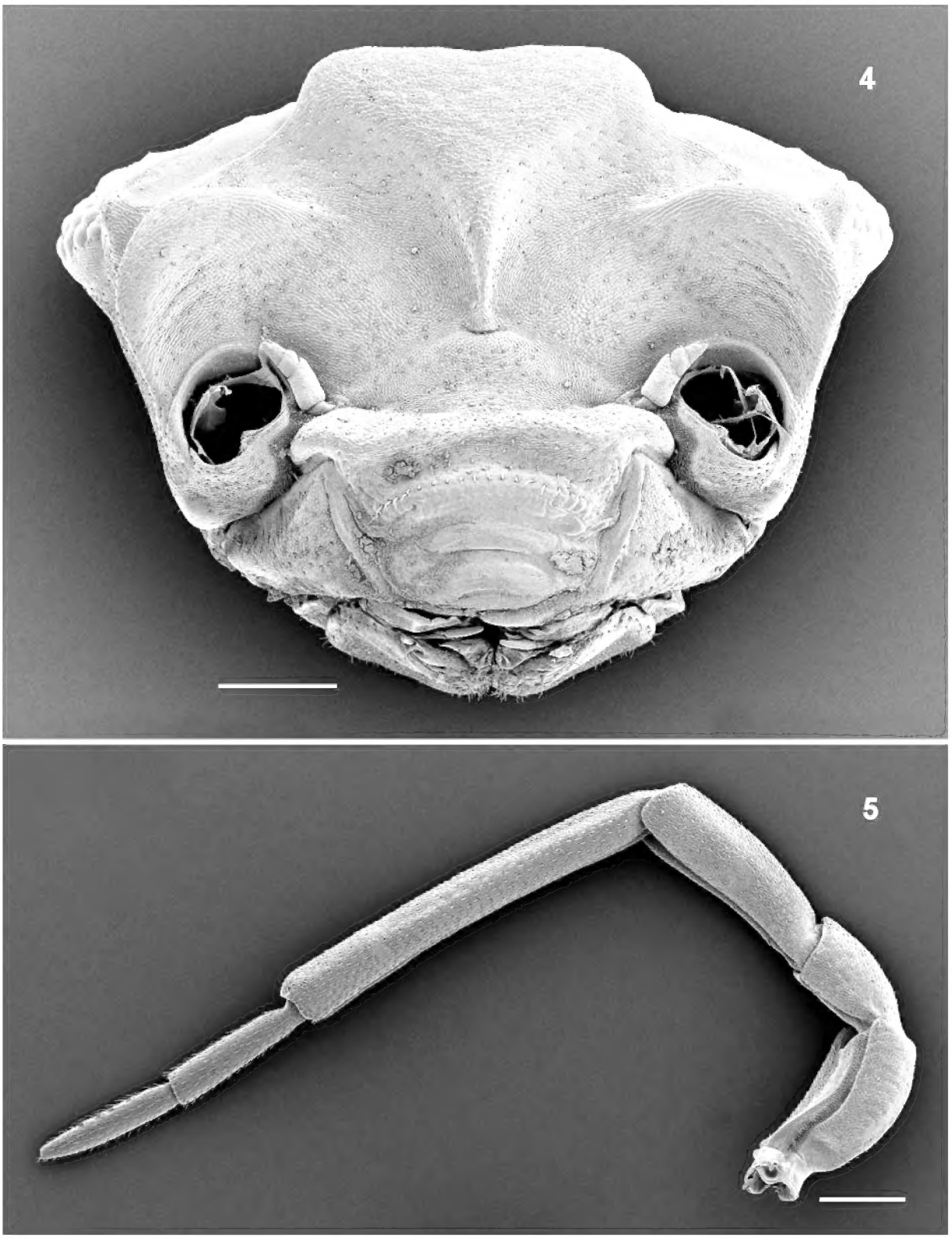
Coloration: Three rows of yellow spots on tergites, epimera and telson yellow.

Cuticular structures: Tergites slightly granulated.

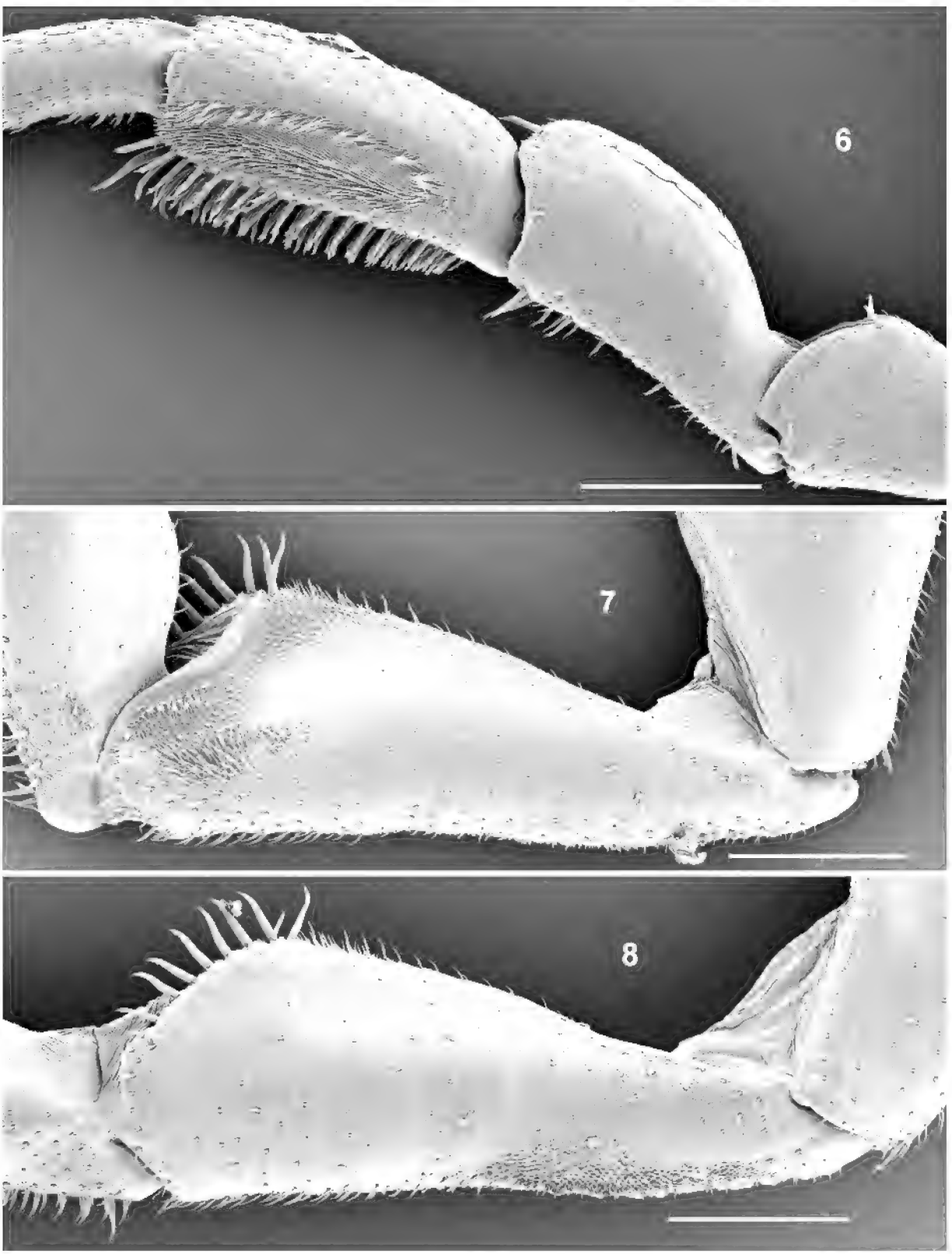
Frontal shield from behind surpassing frontal margin of head at least by one third of its width, laterally with rounded or pronounced angles (Figs. 2–3); antennal lobes trapezoidal (Fig. 4). Hind margin of pereion-epimeron 1 with rounded angle (Fig. 9). Telson slightly longer than wide, with straight sides and broadly rounded apex (Fig. 10). Flagellum of antenna with the two segments of about the same length (Fig. 5). Male pereiopod 1 with dense brush of short spines on carpus, but not on merus (Fig. 6). Male ischium 7 ventrally nearly straight, frontally with a small distal field of setae, caudally with a proximal



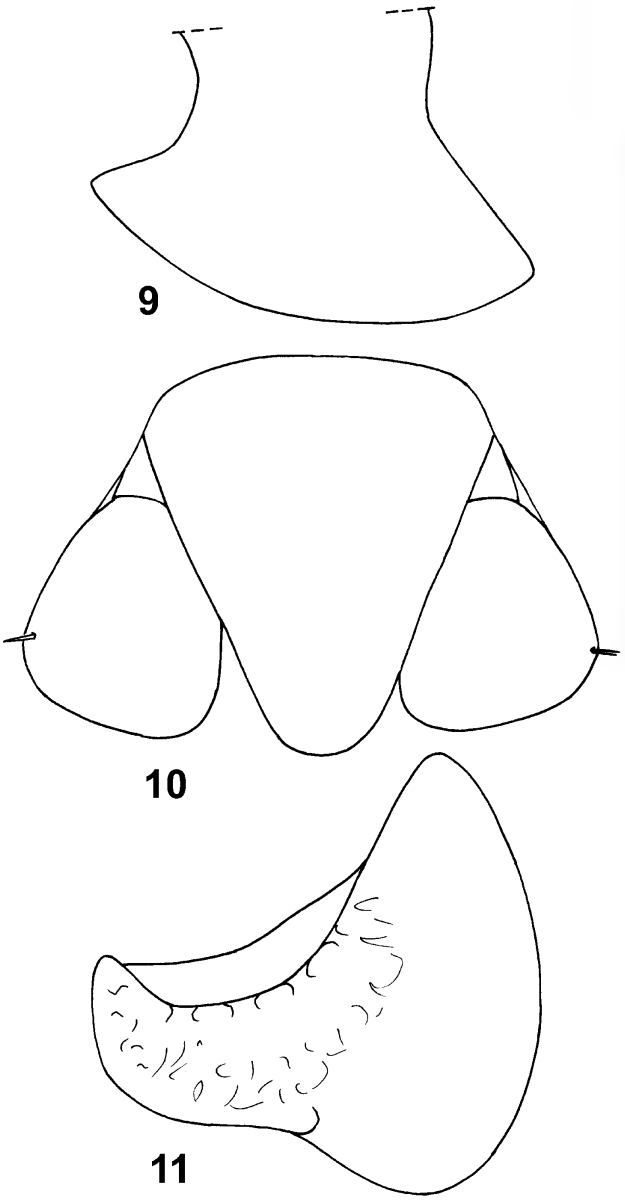
Figs. 2–3. *Armadillidium albanicum* (prefecture Ioánnina, SMNS 1487), ♂, 11.5 × 5.5 mm. – **2**. Head and pereion-tergite 1, dorsal view. **3**. Head, dorsal view. – Scales: 0.5 mm.



Figs. 4–5. *Armadillidium albanicum* (4: prefecture Ioánnina, SMNS 1487, ♀, 15.5 × 7.0 mm; 5: island Kérkira, SMNS 2173, ♂, 16.8 × 8.4 mm). – **4**. Head, frontal view. **5**. Antenna. – Scales: 0.5 mm.



Figs. 6–8. *Armadillidium albanicum* (island Kérkira, SMNS 2173), ♂, 16.8 × 8.4 mm. – **6**. Pereiopod 1, frontal view. **7**. Ischium 7, frontal view. **8**. Ischium 7, caudal view. – Scales: 0.5 mm.



Figs. 9–11. *Armadillidium albanicum* (island Kérkira, SMNS 2173), ♂, 16.8 × 8.4 mm. – **9**. Pereion-epimeron 1, lateral view. **10**. Telson and uropods in situ, dorsal view. **11**. Pleopod-exopodite 1, dorsal view.

area of scales (Figs. 7–8). Male pleopod-exopodite 1 with pronounced triangular hind-lobe (Fig. 11), endopodite 1 with apex straight, the extreme tip slightly pointing outwards (SCHMALFUSS 1981: fig. 7).

Distribution (map Fig. 12)

For sure known from southern Albania, the Greek island Kérkira and the northwestern Greek mainland

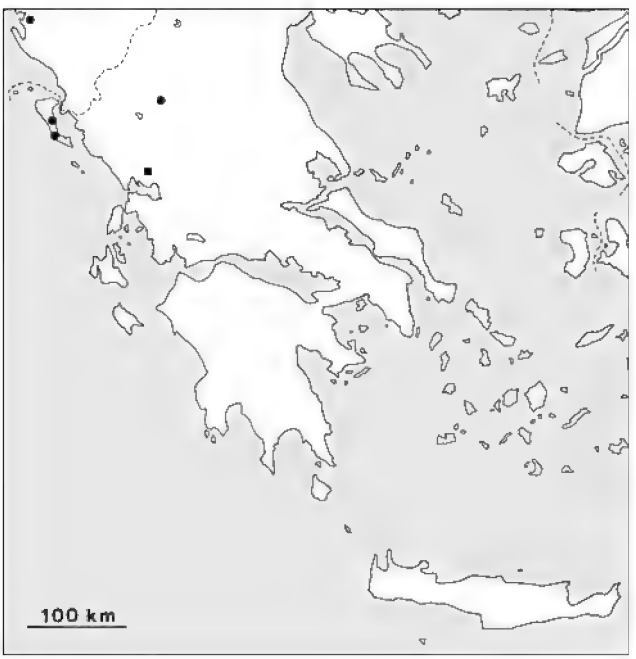


Fig. 12. Safe records of *Armadillidium albanicum* (●) and of *A. artense* (■).

(district Ioánnina, see record in the present paper). A record from the Aegean island Tínos is certainly wrong (compare STROUHAL 1966: 257).

Remarks

In a former publication (SCHMALFUSS 1981: 277, figs. 1–7) I have redescribed the type material of this species and designated a lectotype (SMNS T37); paralectotypes in SMNS (T39), ZMHB (Nr. 10293) and BMNH.

Perhaps *Armadillidium astriger* (non Koch, 1841) reported from Kérkira by VOGL (1876: 513) belongs to this species (compare STROUHAL 1927: 15, 1929: 91), but the material was not retrievable.

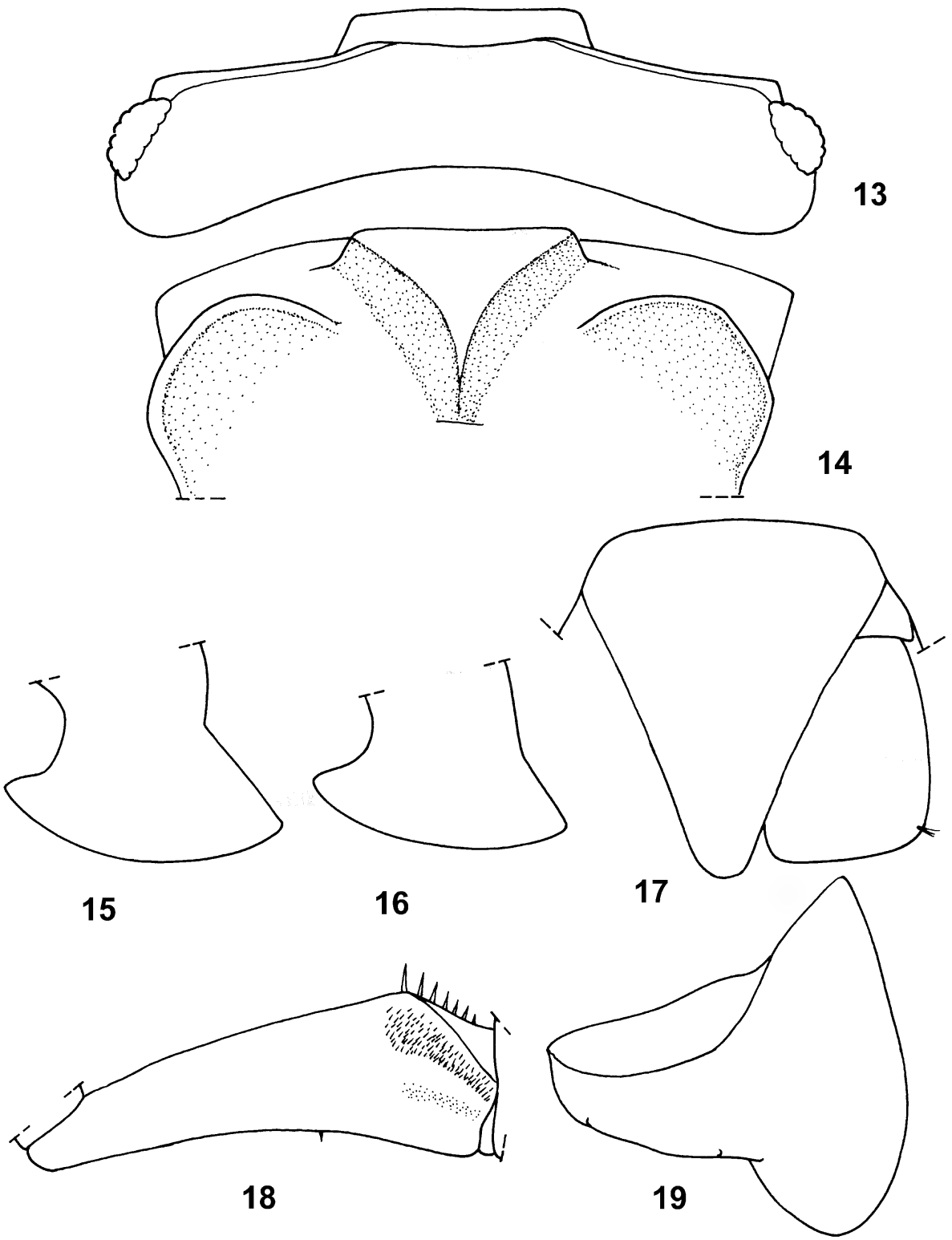
3.2 *Armadillidium artense* Strouhal, 1956
(Figs. 13–19, map Fig. 12)

Literature records

STROUHAL 1942: 149 (nomen nudum; GR, western mainland, surroundings of Árta); STROUHAL 1956: 599, figs. 22–27 (surroundings of Árta).

Material examined

Greece: 13 ex. (syntypes), western mainland, surroundings of Árta, leg. BEIER, 30.IV.–3.V.1932 (NMW). – 8 ex. (syntypes), as before, Petrovúni, leg. BEIER, 29.IV.1932 (NMW).



Figs. 13–19. *Armadillidium artense* (Petrovúni near Árta, syntypes). – **13**. ♂, 13.5 × 6.8 mm, head, dorsal view. **14**. ♂, 13.5 × 6.8 mm, head, frontal view. **15**. ♂, 7.2 mm wide, pereion-epimeron 1, lateral view. **16**. ♂, 6.5 mm wide, pereion-epimeron 1, lateral view. **17**. ♂, 13.5 × 6.8 mm, telson and uropods, dorsal view. **18**. ♂, 15 mm long, ischium 7, frontal view. **19**. ♂, 15 mm long, pleopod-exopodite 1, dorsal view.

Diagnostic characters

Maximum dimensions: 15.0 × 7.7 mm (STROUHAL 1956).

Coloration: Bluish gray, females and juveniles lighter.

Cuticular structures: Tergites strongly tuberculated (stronger than *A. jonicum*).

Frontal shield from behind surpassing frontal margin, upper margin straight, laterally with rounded angles (Fig. 13); antennal lobes trapezoidal (Fig. 14). Hind margin of pereion-epimeron 1 variable, with obtuse angle or rounded, extreme shapes illustrated in Figs. 15–16. Telson longer than wide, with straight sides and rounded apex (Fig. 17). Flagellum of antenna in adults with distal segment slightly shorter than proximal one. Male ischium 7 ventrally concave, frontal side with distal hair-field (Fig. 18). Male pleopod-exopodite 1 with pointed triangular hind-lobe (Fig. 19), endopodite 1 with apex straight.

Distribution (map Fig. 12)

Greece, western mainland, surroundings of Árta.

Remarks

In the collection of the SMNS the species is not present. The drawings were made after type material, which I had loaned many years ago from the NMW. STROUHAL had made slide preparations of pereiopods and pleopods of the two biggest males from the type series from Petrovúni. These preparations were at my disposal, the specimens were, however, not present in the investigated type material. Therefore no lectotype is designated.

3.3 *Armadillidium bicurvatum* Verhoeff, 1901

This species was treated in the 23rd contribution of this series (SCHMALFUSS 2006a). It is known from the western parts of Greece including the Peloponnese and western Crete and has also been found in southern Albania (SCHMALFUSS 2006a: map fig. 51).

3.4 *Armadillidium corcyraeum* Verhoeff, 1901 (Figs. 20–29, map Fig. 30)

Synonyms: *A. graecorum* Verhoeff, 1907, *A. odysseum* Verhoeff, 1901.

Literature records

VERHOEFF 1901b: 68 (GR, Ionian island "Korfu" = Kérkira); VERHOEFF 1901c: 138 (*A. odysseum*, island "Korfu" = Kérkira); VERHOEFF 1907: 474 (*A. graecorum*, GR, western mainland district Préveza); STROUHAL 1927: 25 (*A. odysseum*, Ionian islands "Korfu" = Kérkira and "S. Maura" = Lefkáda); STROUHAL 1929: 95, figs. 30–32 (island "Korfu" = Kérkira); STROUHAL 1936: 99 (island "Korfu" = Kérkira); STROUHAL 1937a: 129 (island "Korfu" = Kérkira); STROUHAL 1956: 597 (island "Korfu" = Kérkira); STROUHAL 1966: 295, figs. 23–28 (island "Korfu" = Kérkira); SCHMALFUSS 1981: 281, figs. 28–34 (GR, Ionian island Paxí; not: central mainland, district Tríkala, see Remarks); SCHMALFUSS 1985a: 10 (GR, Ionian island Paxí); SCHMALFUSS 1985b: 291 (GR, Ionian island Lefkáda; western mainland, districts Thesprotía and Préveza).

The reports from the Ionian islands Kefalloniá (STROUHAL 1927: 25) and Zákinthos (= "Zante") (STROUHAL 1939: 184) need confirmation, because they refer to females only. A collection from Kefalloniá and Zákinthos (SMNS, leg. ERHARD & SCHMALFUSS 1996) with more than 600 specimens of *Armadillidium* does not contain any specimens of *A. corcyraeum*.

Material examined

Greece: 1 ex., Ionian island Kérkira, Sidári, leg. SCHAWALLER & SCHEUERN, 21.IV.1981 (SMNS 1397). – 1 ex., island Kérkira, Nimfés, leg. MALICKY, 28.IX.1980 (SMNS 1376). – 5 ex., island Kérkira, Kávos, leg. SCHAWALLER & SCHEUERN, 13.IV.1981 (SMNS 1394). – 49 ex., Ionian island Paxí, leg. HAUSEN, IV.1979 (SMNS 1139), and leg. SCHAWALLER & SCHEUERN, 17.–19.IV.1981 (SMNS 1391, 1422, 1424, 1425). – 18 ex., Ionian island Lefkáda, leg. GOESSLER, VII.1910 (SMNS 2066). – 2 ex., western mainland, prefecture Ioánnina, Lake of Ioánnina, northeastern shore, leg. VIGNA, 8.XI.1981 (SMNS 2152). – 14 ex., western mainland, prefecture Thesprotía, 23 km S of Igumenítsa, 150 m, maquis and *Quercus macrolepis*, leg. SCHMALFUSS, 7.V.1994 (SMNS 2425). – 12 ex., prefecture as before, Sívota, 25 km S of Igumenítsa, coastal maquis, leg. SCHAWALLER, 6.V.1994 (SMNS 2444). – 15 ex., as before, 12 km NE of Igumenítsa, leg. SCHAWALLER, 6.V.1994 (SMNS 2445). – 4 ex., as before, 2 km NE of Kartéri, leg. BAEHR, 17.IV.1983 (SMNS 2016). – 6 ex., as before, Mórfi, leg. BAEHR, 18.IV.1983 (SMNS 2000), and leg. THALER & KNOFLACH, 21.IX.1996 (SMNS 2790). – 2 ex., western mainland, prefecture Préveza, 3 km N of Mirsíni, leg. MALICKY, 16.IV.1984 (SMNS 2112). – 5 ex., as before, N of Préveza, 500 m, leg. BAEHR, 18.IV.1983 (SMNS 2014).

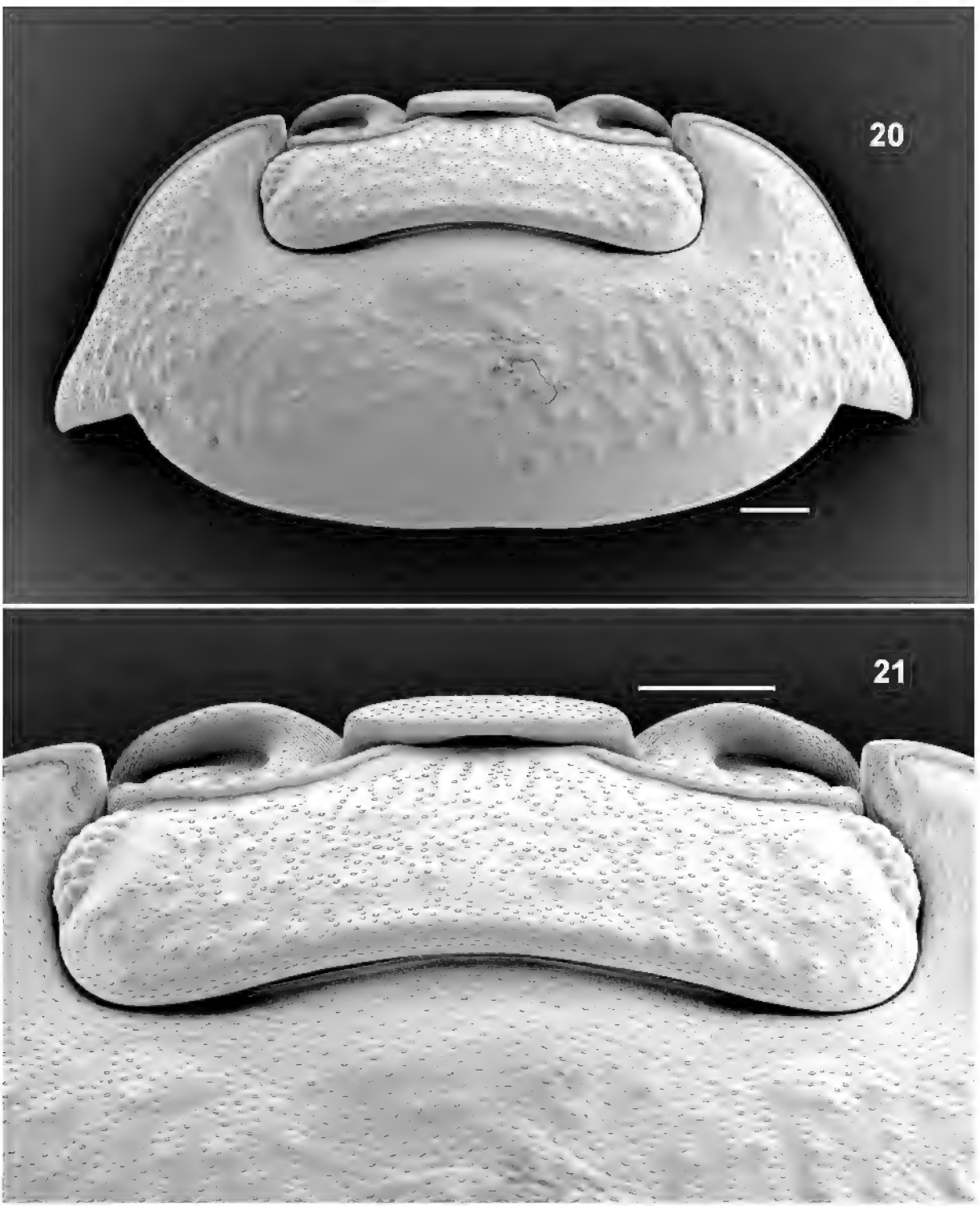
Diagnostic characters

Maximum dimensions: 19.0 × 8.5 mm.

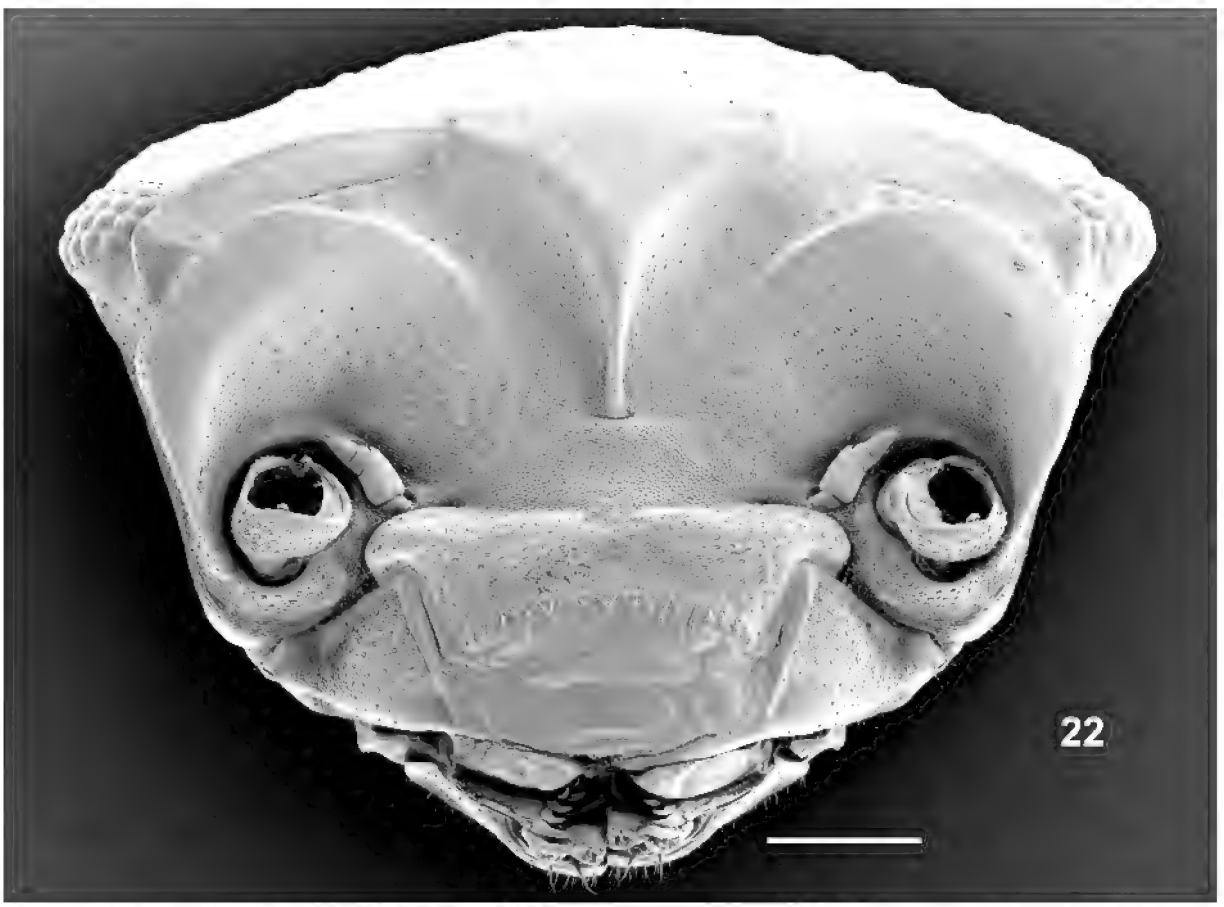
Coloration: Tergites gray, many specimens from the islands and the coast with three rows of white spots on pereion tergites, sometimes a white band on pereion tergite 1, also uropods can be white. Specimens from inland localities without white spots, uniformly gray. Juveniles brownish with epimera lighter.

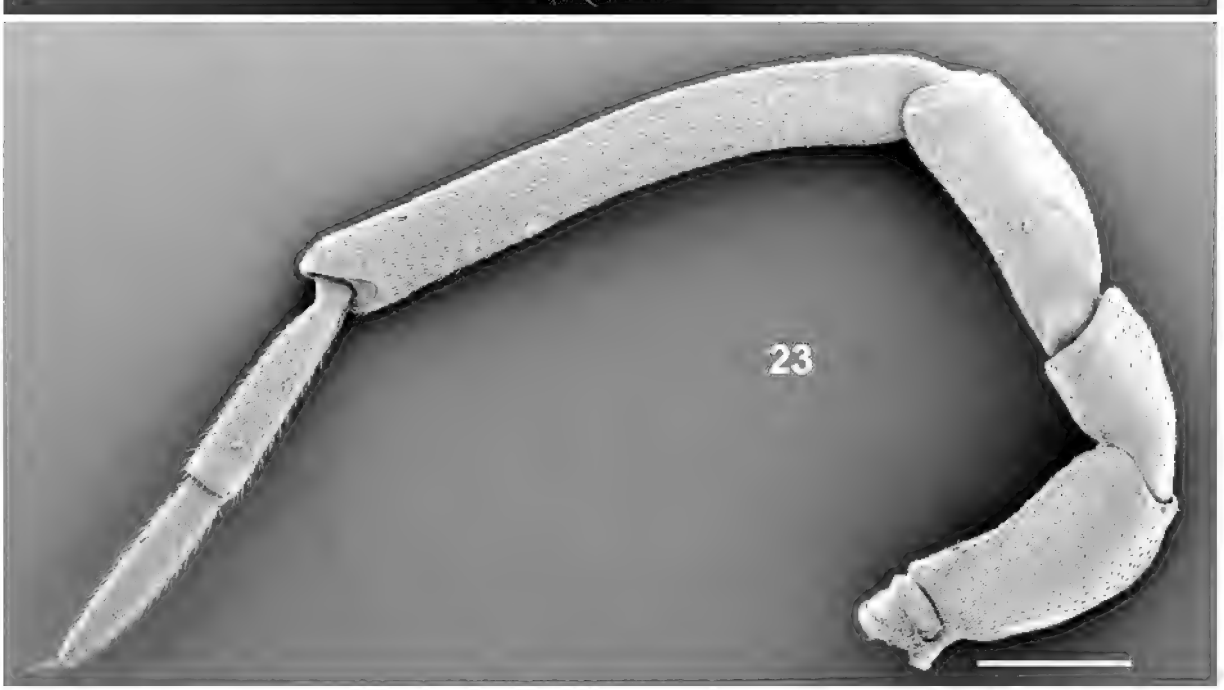
Cuticular structures: Variable, tergites from heavily to faintly granulated (Fig. 20).

Frontal shield from behind slightly surpassing frontal margin of head, upper margin straight, with oblique angles laterally (Figs. 20–21); antennal lobes in frontal view trapezoidal with rounded medial part (Fig. 22). Hind margin of pereion-epimeron 1 with distinct or rounded angle (Fig. 27). Telson as wide as long, with nearly straight sides and broadly rounded or truncate apex (Fig. 28). Antenna see Fig. 23, the two segments of the flagellum of nearly the same length. Male carpus 1 with brush of short spines (Fig. 24). Male ischium 7 ventrally slightly concave, frontally with distal hair-field (Figs. 25–26). Male pleopod-exopodite 1 with long pointed hind-lobe (Fig. 29), endopodite 1 with apex straight, the very tip slightly pointing outwards (SCHMALFUSS 1981: fig. 34).

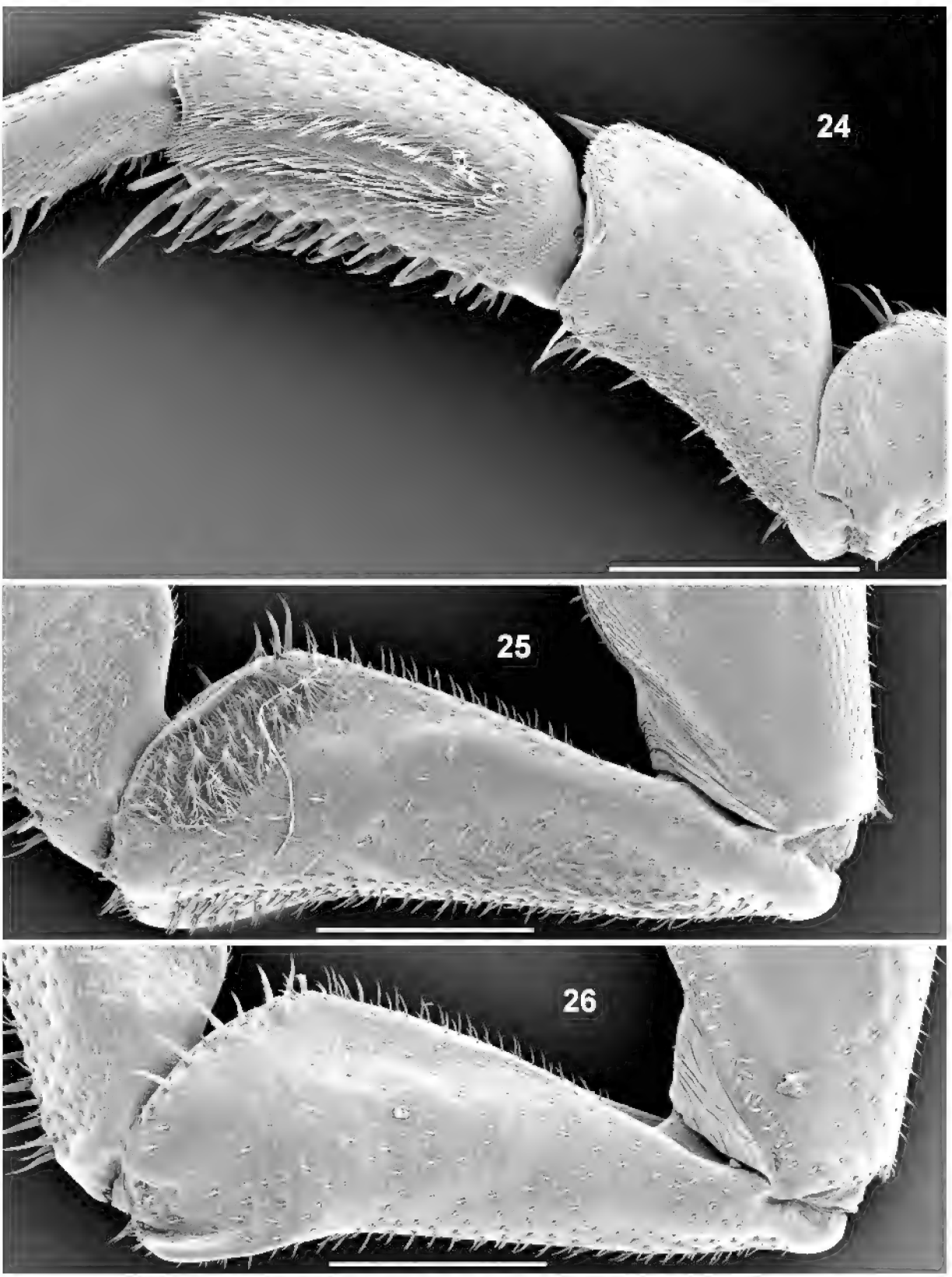


Figs. 20–21. *Armadillidium corcyraeum* (S of Igumenítsa, SMNS 2444), ♀, 13.5 × 6.5 mm. – **20**. Head and pereion-tergite 1, dorsal view. **21**. Head, dorsal view. – Scales: 0.5 mm.

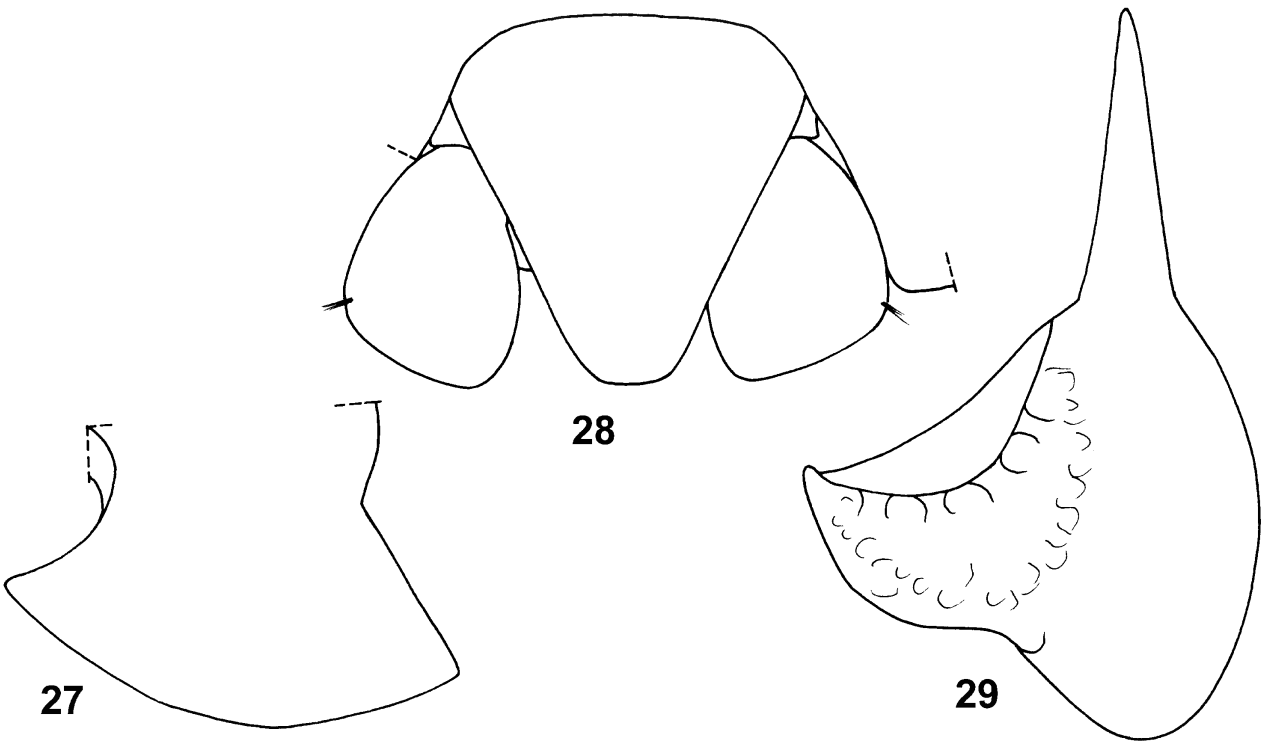




Figs. 22–23. *Armadillidium corcyraeum* (S of Igumenítsa, SMNS 2444). – **22**. ♀, 15.0 × 6.6 mm, head, frontal view. **23**. ♂, 15.5 × 6.8 mm, antenna. – Scales: 0.5 mm.



Figs. 24–26. *Armadillidium corcyraeum* (S of Igumenítsa, SMNS 2444), ♂, 15.5 × 6.8 mm. – **24**. Pereiopod 1, frontal view. **25**. Ischium 7, frontal view. **26**. Ischium 7, caudal view. – Scales: 0.5 mm.



Figs. 27–29. *Armadillidium corcyraeum* (S of Igumenítsa, SMNS 2444), ♂, 15.5 × 6.8 mm. – **27**. Pereion-epimeron 1, lateral view. **28**. Telson and uropods in situ, dorsal view. **29**. Pleopod-exopodite 1, dorsal view.

Distribution (map Fig. 30)

Known for sure from the Ionian islands Kérkira and Lefkáda and the adjacent mainland of the western Epirus, but certainly to be expected also in southern Albania.

Remarks

Strouhal (1929: 95) synonymized *A. odysseum* Verhoeff, 1901 with *A. corcyraeum*. I have examined type material of *A. graecorum* Verhoeff, 1907 and came to the conclusion, after comparison with the type specimens of *A. corcyraeum*, that it is also a synonym of this species (Schmalfuss 1981: 281). On the other hand *A. simile* seems to be a separate species, contrary to my suggestion made in Schmalfuss (1985b: 291). The samples from Kalambaka (SMNS 1721, 1843) which were published as *A. corcyraeum* in Schmalfuss (1981) are also considered a different species and will be described in a future contribution.

The species exhibits a certain variability concerning the shape of the pereion-epimeron 1, the granulation of the tergites, and the coloration. If the specimen figured as *A. corcyraeum* from Kérkira in Strouhal (1966: figs. 24–28) belongs to this species, also the male pleopod-exopodite 1 shows a variable structure. Further detailed studies may reveal *A. corcyraeum* to be a sort of superspecies, which has to be split into a number of separate entities on the species level.

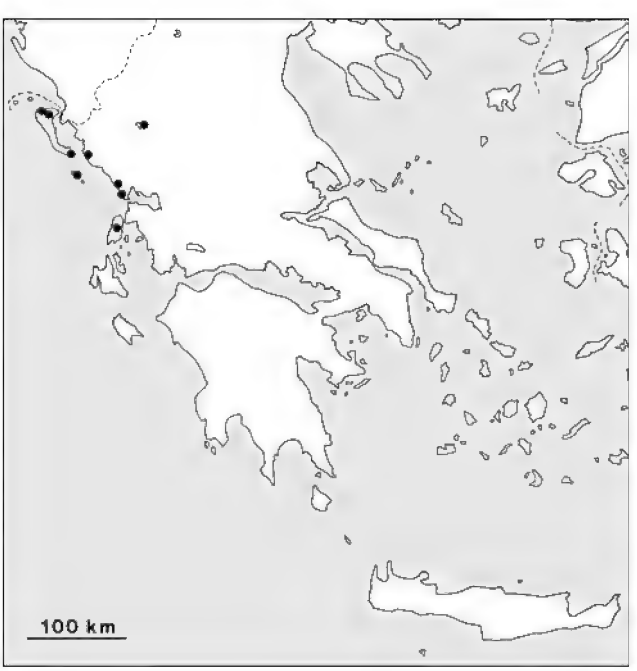
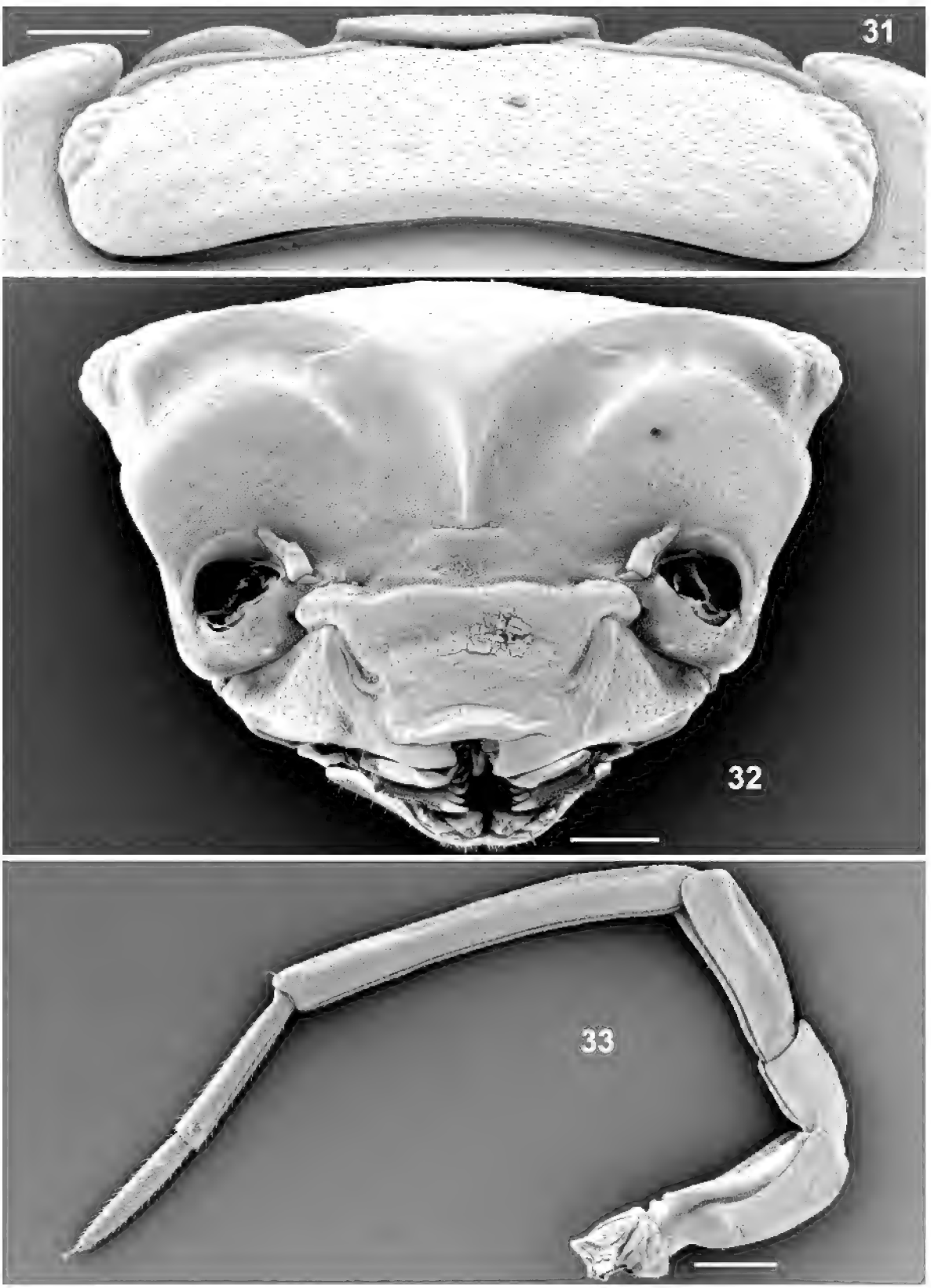
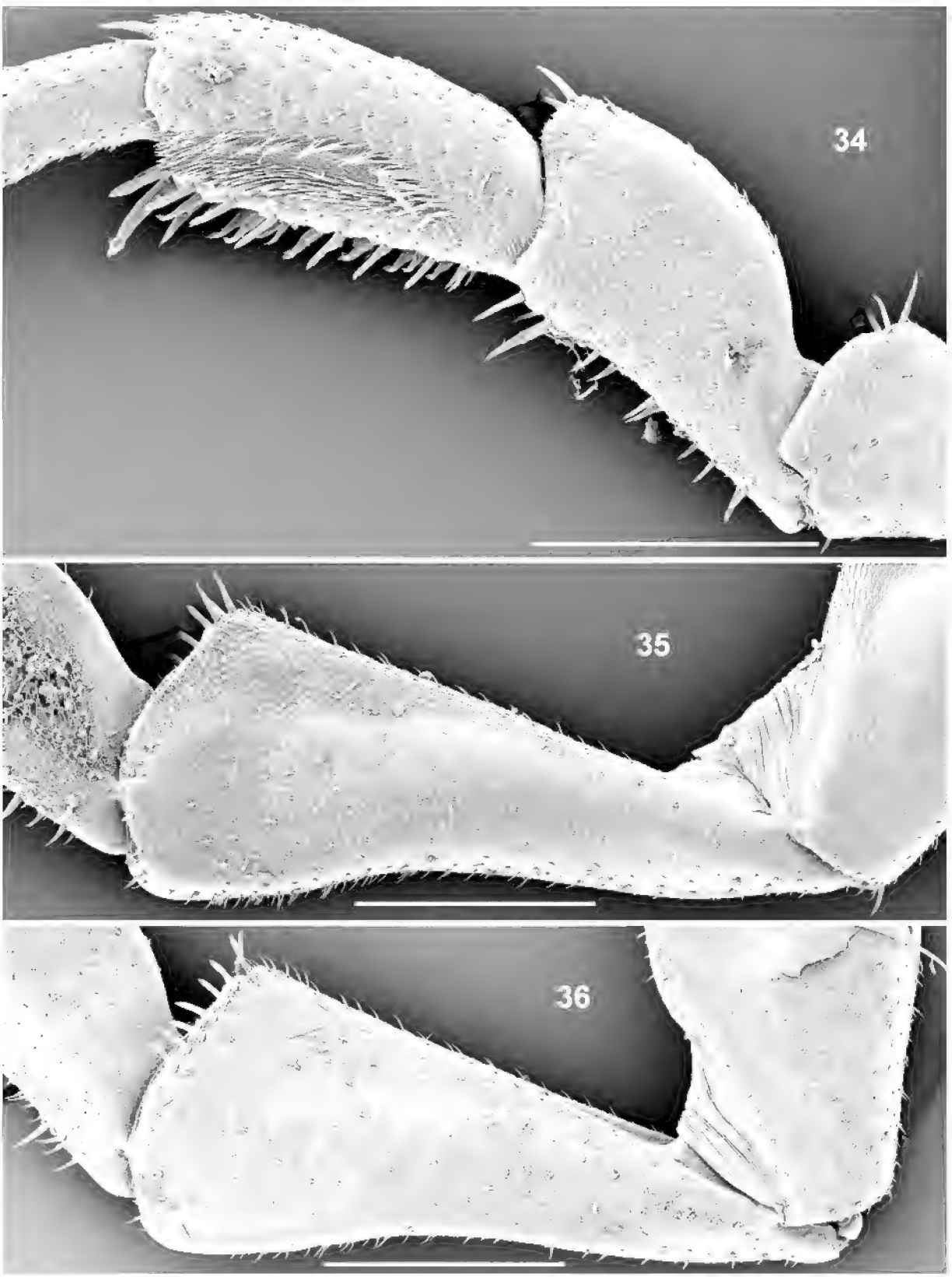


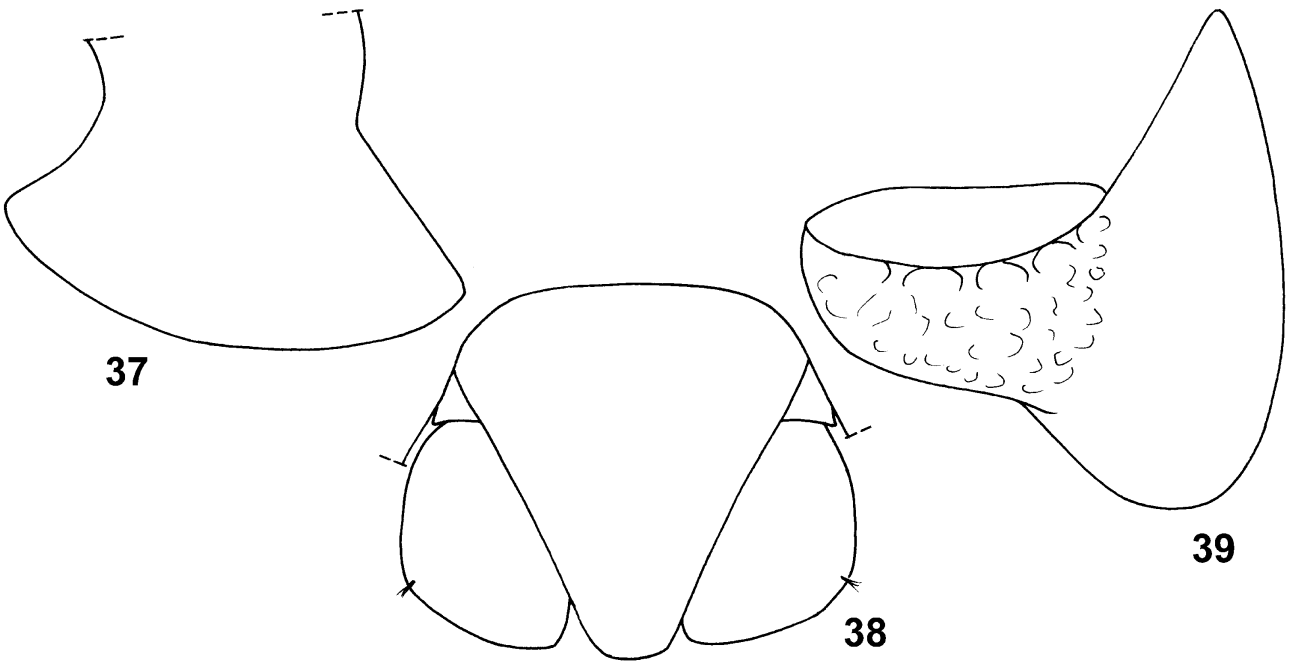
Fig. 30. Records of *Armadillidium corcyraeum*.



Figs. 31–33. *Armadillidium epiroticum* (31: prefecture Àrta, SMNS 2134, ♂, 12.0 × 5.5 mm; 32–33: prefecture Préveza, SMNS 2021, ♀, 19.2 × 9.2 mm). – **31**. Head, dorsal view. **32**. Head, frontal view. **33**. Antenna. – Scales: 0.5 mm.



Figs. 34–36. *Armadillidium epiroticum* (prefecture Àrta, SMNS 2134), ♂, 12.2 × 5.8 mm. – **34**. Pereiopod 1, frontal view. **35**. Ischium 7, frontal view. **36**. Ischium 7, caudal view. – Scales: 0.5 mm.



Figs. 37–39. *Armadillidium epiroticum* (prefecture Àrta, SMNS 2134), ♂, 12.2 × 5.8 mm. – **37**. Pereion-epimeron 1, lateral view. **38**. Telson and uropods in situ, dorsal view. **39**. Pleopod-exopodite 1, dorsal view.

3.5 *Armadillidium epiroticum* Strouhal, 1956 (Figs. 31–39, map Fig. 40)

Literature records

Strouhal 1942: 148 (*A. jonicum epiroticum*, nomen nudum; GR, western mainland, surroundings of mountain Xerovúni in the southeastern corner of the prefecture Ioánnina); Strouhal 1956: 598, figs. 18–19 (*A. jonicum epiroticum*; locality as before).

Material examined

Greece: 12 ex. and appendage preparations of two further ♂♂ (syntypes), western mainland, province Epirus, prefecture Árta, Xerovúni Mountain, Nisísta, 700–800 m, leg. Beier, 30.V.–1.VI.1933 (NMW). – 2 ex., prefecture Árta, northern shore of the Amvrakikós Gulf, Salaóra, leg. Wolff & Loosjes, 30.IV.1964 (SMNS 2134). – 1 ex., province Epirus, prefecture Préveza, 2 km E of Kanalláki, leg. Baehr, 18.IV.1983 (SMNS 2021).

Diagnostic characters

Maximum dimensions: 19.5 × 9.0 mm (Strouhal 1956).

Coloration: Dark gray, juveniles brownish.

Cuticular structures: Tergites weakly granulated (more weakly than *A. jonicum*).

Frontal shield from behind not surpassing frontal margin, upper margin straight (Fig. 31); antennal lobes trapezoidal (Fig. 32). Hind margin of pereion-epimeron 1 with sharp angle (Fig. 37). Telson nearly as wide as long, with straight sides and rounded apex (Fig. 38). Flagellum of antenna in adults with distal segment slightly shorter than proximal one (Fig. 33). Male carpus 1 with weakly developed ventral brush of spines (Fig. 34). Male ischium 7 ventrally slightly concave, frontal side without distal

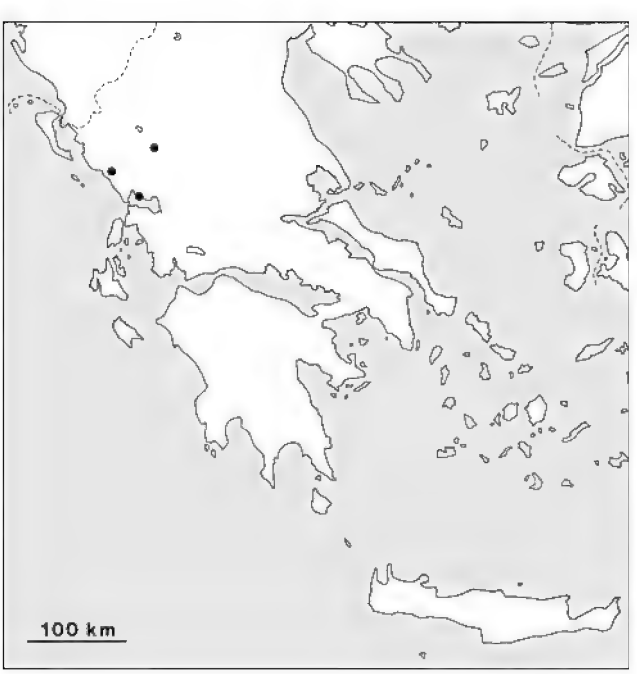
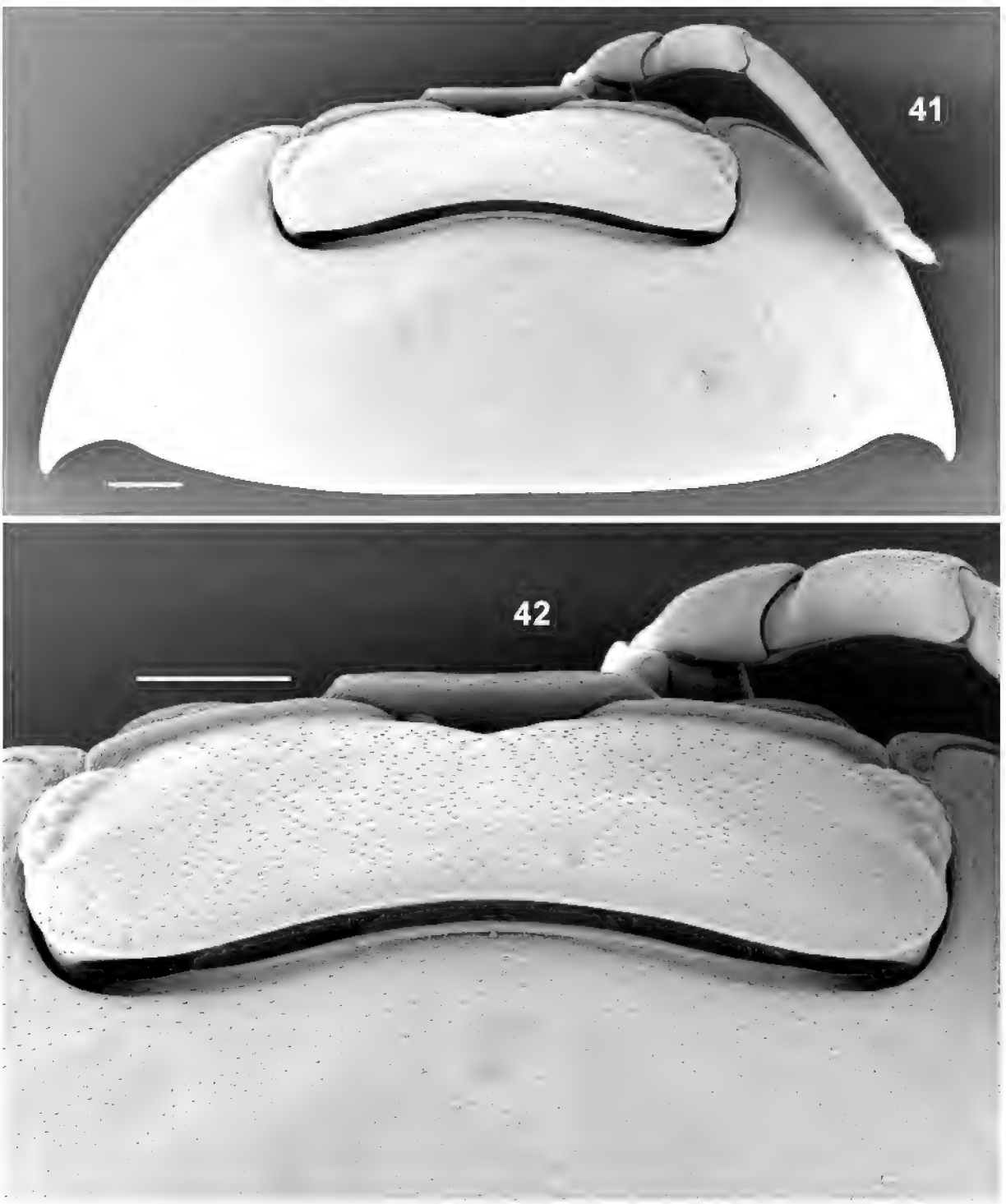
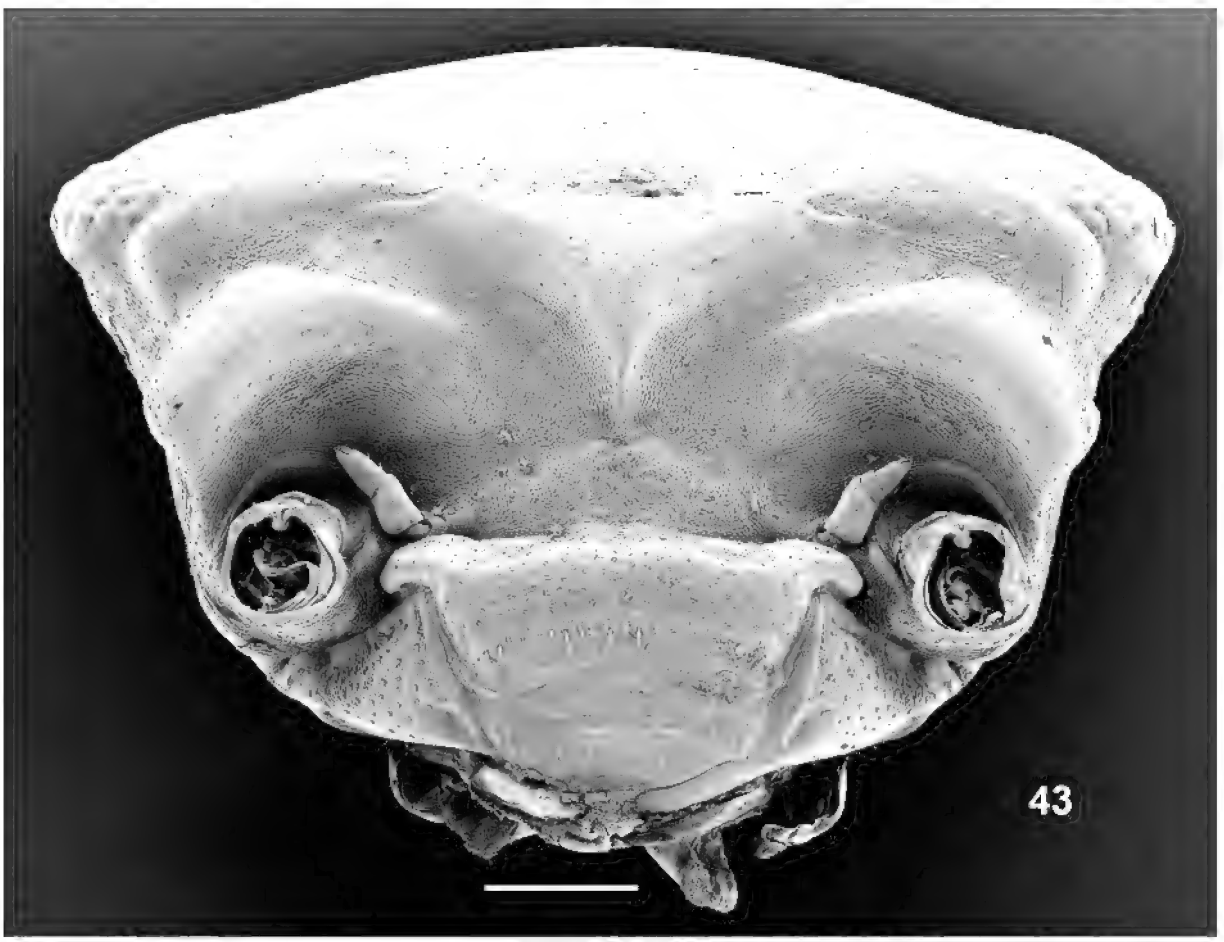


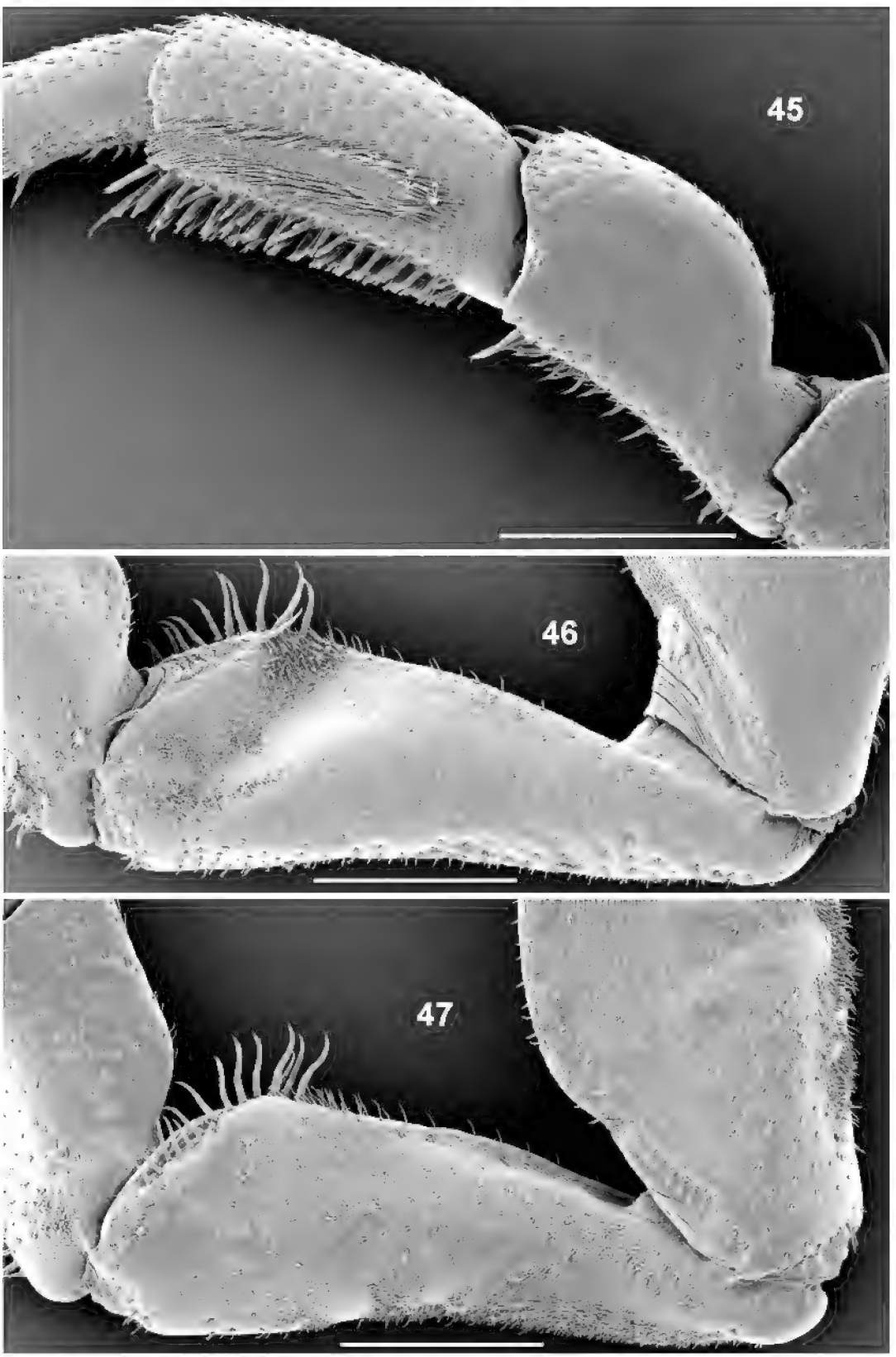
Fig. 40. Records of *Armadillidium epiroticum*.



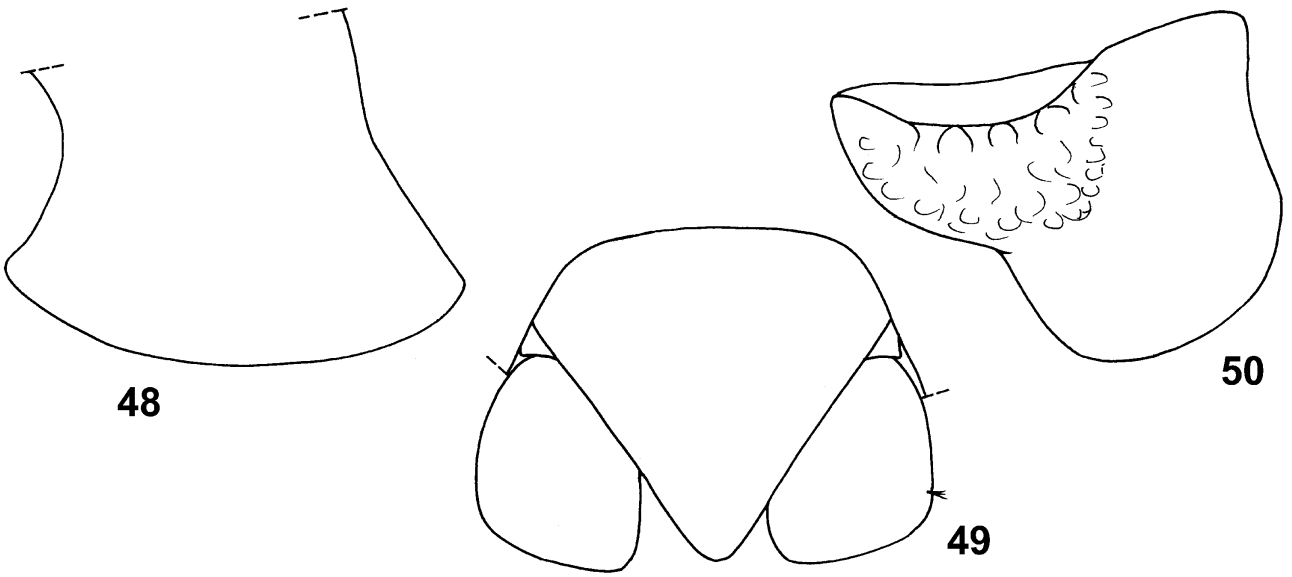
Figs. 41–42. *Armadillidium frontetriangulum* (Tímfi Mountain, SMNS 2869), ♂, 12.3 × 5.8 mm. – **41**. Head and pereion-tergite 1, dorsal view. **42**. Head, dorsal view. – Scales: 0.5 mm.



Figs. 43–44. *Armadillidium frontetriangulum* (island Kérkira, SMNS 2172), ♂, 15.2 × 7.0 mm. – **43**. Head, frontal view. **44**. Antenna. – Scales: 0.5 mm.



Figs. 45–47. *Armadillidium frontetriangulum* (island Kérkira, SMNS 2172), ♂, 15.2 × 7.0 mm. – **45**. Pereiopod 1, frontal view. **46**. Ischium 7, frontal view. **47**. Ischium 7, caudal view. – Scales: 0.5 mm.



Figs. 48–50. *Armadillidium frontetriangulum* (island Kérkira, SMNS 2172), ♂, 15.2 × 7.0 mm. – **48**. Pereion-epimeron 1, lateral view. **49**. Telson and uropods in situ, dorsal view. **50**. Pleopod-exopodite 1, dorsal view.

hair-field (Figs. 35–36). Male pleopod-exopodite 1 with pointed triangular hind-lobe (Fig. 39), endopodite 1 with apex straight.

Distribution (map Fig. 40)

Greece, western mainland, southernmost part of province Epirus.

Remarks

STROUHAL had made slide preparations of pereiopods and pleopods from type specimens. These preparations were at my disposal, the specimens were, however, not present in the investigated type material loaned from the NMW. Therefore no lectotype is designated.

This taxon was described as subspecies of *A. jonicum*. The somatic characters (head, pereion-epimera, telson) are nearly identical with the nominate form of *jonicum*, the male sexual characters (ischium 7, pleopod-exopodite 1) show, however, differences which are inside the genus *Armadillidium* normally used as criteria for a separate species status. Thus *epiroticum* is here considered a separate species.

3.6 *Armadillidium frontetriangulum* Verhoeff, 1901 (Figs. 41–50, map Fig. 51)

Literature records

VERHOEFF 1901c: 138 (GR, Ionian island Kérkira = Korfu); VERHOEFF 1902: 243 (GR, western mainland, prefecture Ioánnina, "Han Driskos", which is near the village Vasilikí E of Lake of Ioánnina); STROUHAL 1927: 34 (GR, Ionian island Kefalloniá); STROUHAL 1936: 105, figs. 23–24 (Ionian island Kérkira); STROUHAL 1937a: 129 (Ionian island Kérkira); STROUHAL 1956: 611 (GR, western mainland, southeastern corner of prefecture Ioánnina, and northern part of prefecture Préveza); STROUHAL 1966: 304 (Ionian island Kérkira); SCHMALFUSS 1981: 283, figs. 42–47.

Material examined

Greece: 1 ♂, Ionian island Kérkira, Pantokrátoras, near Spartílas, leg. HAUSER, 9.IV.1972 (SMNS 2172). – 3 ex., province Epirus, prefecture Ioánnina, Tímfi Mountain, Monódendri, 1000–1500 m, leg. BARTSCH, 21.VI.2005 (SMNS 2869). – 1 ♀, province Epirus, prefecture Thesprotía, 30 km S of Igumenítsa, Mórfí, leg. THALER & KNOFLACH, 21.IX.1996 (SMNS 2790).

Diagnostic characters

Maximum dimensions: 15.0 × 7.5 mm.

Coloration: Dark gray, some population with five rows of yellowish spots on the tergites.

Cuticular structures: Tergites smooth.

Frontal shield from behind slightly surpassing frontal margin, upper margin straight (Figs. 41–42); antennal lobes trapezoidal (Fig. 43). Hind margin of pereion-epimeron 1 with flat rounded angle (Fig. 48). Telson slightly shorter than wide, with straight sides and pointed apex (Fig. 49). Flagellum of antenna with distal segment slightly shorter than proximal one (Fig. 44). Male carpus 1 ventrally with brush of spines (Fig. 45). Male ischium 7 ventrally nearly straight, frontal side with distal groove and small hair-field (Figs. 46–47). Male pleopod-exopodite 1 without hind-lobe, medial margin concave (Fig. 50), endopodite 1 with apex straight.

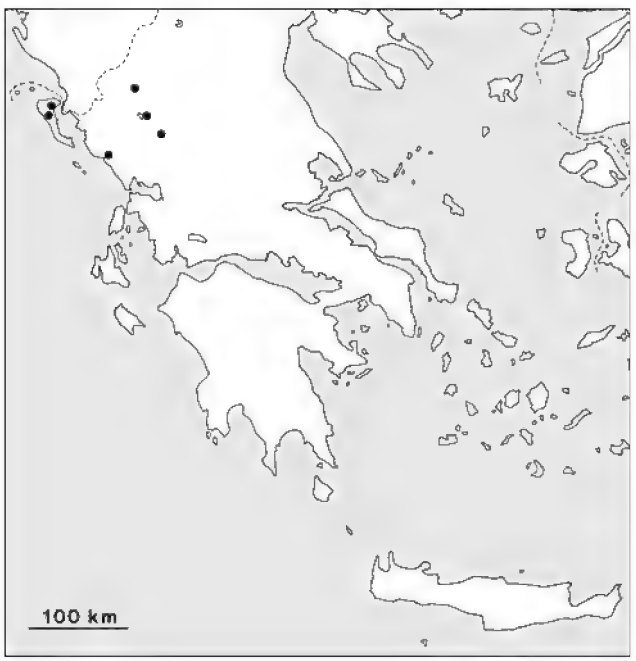


Fig. 51. Records of *Armadillidium frontetriangulum*.

Distribution (map Fig. 51)

Greece, Ionian island Kérkira and the southern part of province Epirus on the western mainland; the record from the Ionian island Kefalloniá (Strouhal 1927) seems doubtful; Strouhal mentions the species without details on collecting data, and we have not found the species on Kefalloniá during a collecting mission in 1996 which had yielded more than 600 *Armadillidium* specimens.

Remarks

The species seems to be the next relative of *A. janinense*, conspicuous common derived characters are the male basipodite 7 with hairy setae along medial margin, male ischium 7 with ventral hair-field on caudal side, and the specific shape of male pleopod-exopodite 1 with medial margin concave.

3.7 *Armadillidium granulatum* Brandt, 1833

The species has been treated in the 23rd contribution of this series (Schmalfuss 2006a). It is known from the coasts of the Mediterranean Sea, east to Asia Minor and Libya, and the southwestern coast of the Black Sea; isolated records exist from the Atlantic coast of Portugal and northern France. A map of the overall distribution is found in Schmalfuss (2000: fig. 3), safe Greek records are mapped in fig. 64 in Schmalfuss (2006a). For the latter map only samples were used which were investigated by the author, because some of the literature records are doubtful. In Strouhal (1956: 594) *A. granulatum* is reported for the southernmost corner of the Epirus (Préveza). This author usually made reliable identifications, so the species can be included in the inventory of the province Epirus.

3.8 *Armadillidium humectum* Strouhal, 1937

The species has been treated in the 23rd contribution of this series (Schmalfuss 2006a). It is known from the western part of Greece (Ionian islands, western mainland and northern Peloponnes) (Schmalfuss 2006a: map fig. 75). In addition to the records listed in the mentioned publication a further sample from the Epirus was found in the SMNS collection: 2 ex., Greece, province Epirus, prefecture Thesprotía, Platariá 12 km S of Igumentítsa, sandy beach, leg. Schawaller, 7.V.1994 (SMNS 2447). In addition to these Greek records it has also been reported from the southwestern coast of Albania (Valona = Vlorë) (Arcangeli 1952: 8).

3.9 *Armadillidium inflatum* Verhoeff, 1907 (Figs. 52–58)

Literature records

Verhoeff 1907: 490 (GR, "Epirus"); Schmalfuss 1981: 285, figs. 48–54.

Material examined

The collection of the SMNS does not contain any samples of this species, so I reproduce the drawings of the diagnostic characters which I published in 1981 and which were based on the holotype ♂.

Diagnostic characters

Maximum dimensions: 11 × 6 mm.

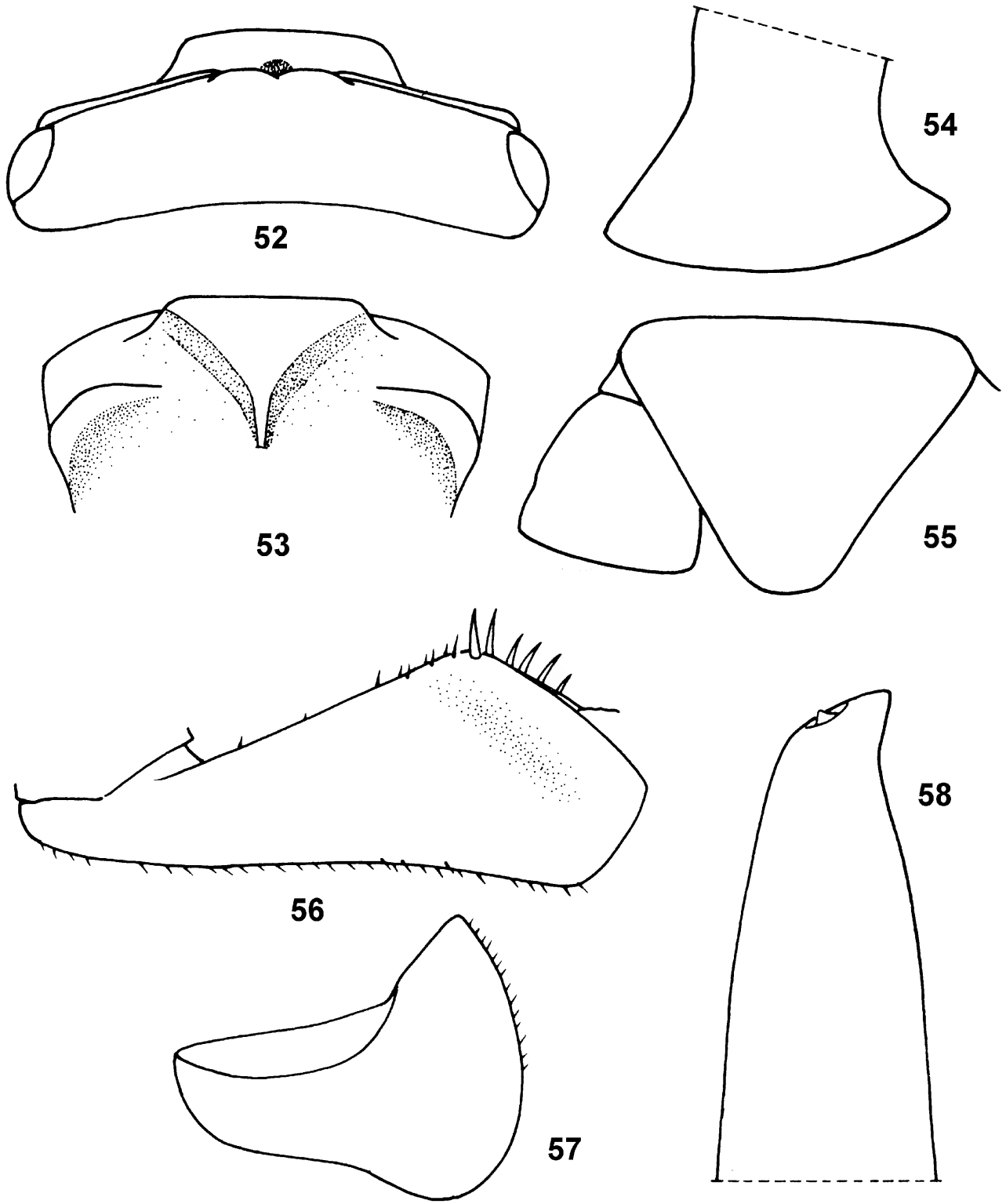
Coloration: Gray, with three conspicuous rows of yellow spots on the pereion-tergites and with yellowish epimera.

Cuticular structures: Tergites smooth.

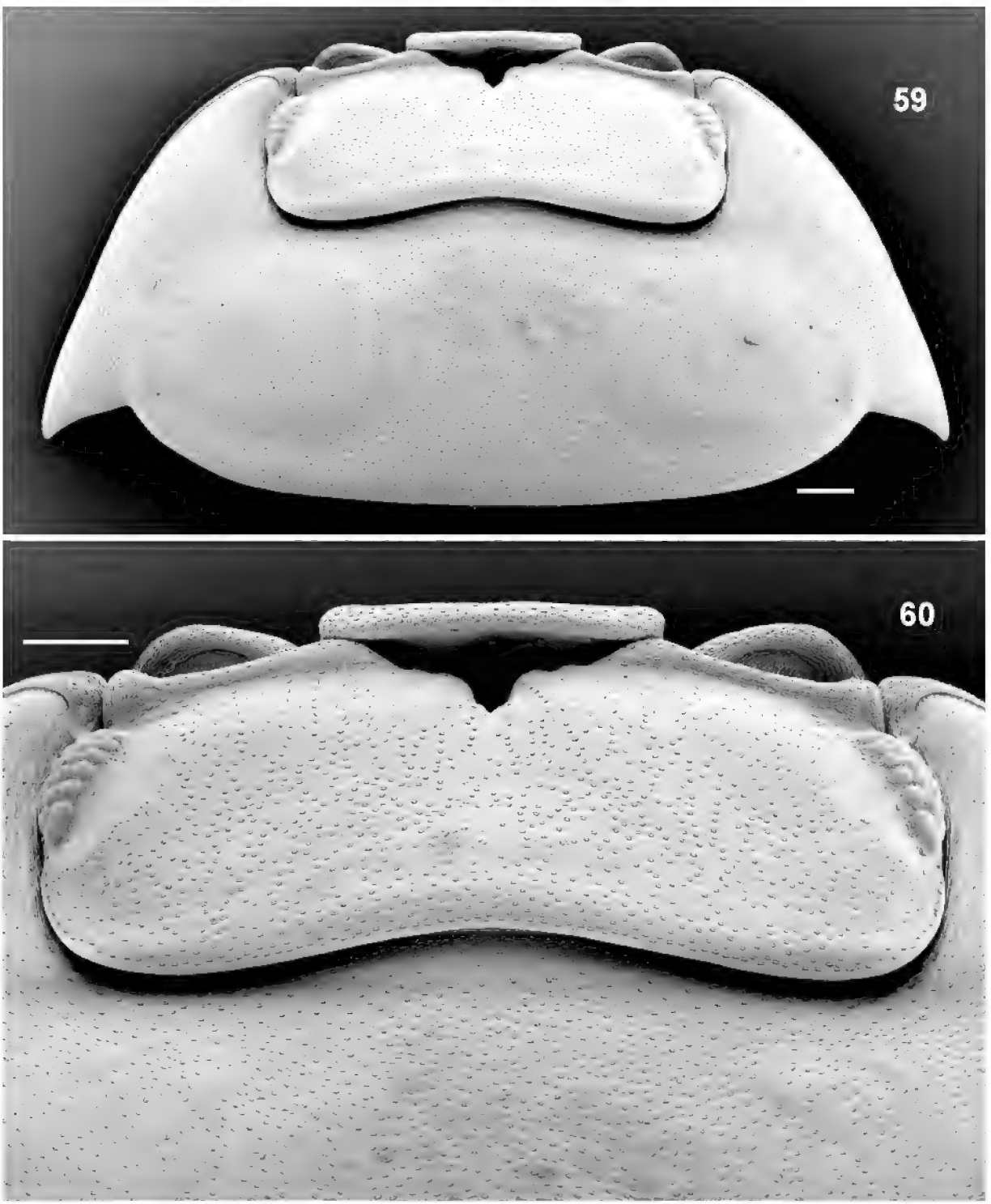
Frontal shield from behind considerably surpassing frontal margin, upper margin straight, laterally with rounded angles (Fig. 52); antennal lobes trapezoidal (Fig. 53). Hind margin of pereion-epimeron 1 with obtuse angle (Fig. 54). Telson wider than long, with straight sides and broadly rounded apex (Fig. 55). Male ischium 7 ventrally nearly straight (Fig. 56). Male pleopod-exopodite 1 with pointed triangular hind-lobe (Fig. 57), endopodite 1 with apex straight (Fig. 58).

Distribution

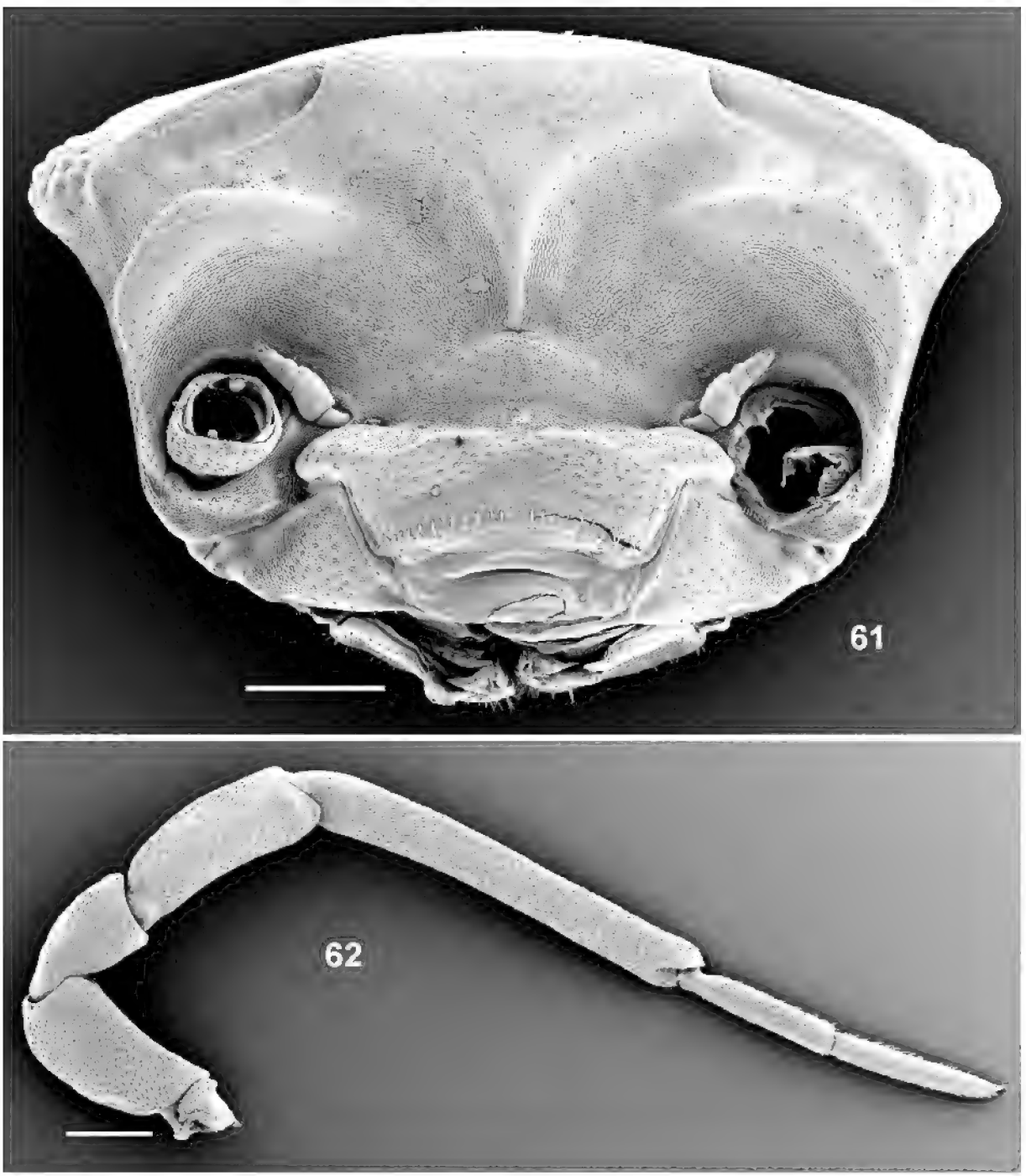
Greece, province Epirus. The holotype from "Epirus" without detailed locality is the only record of this species.



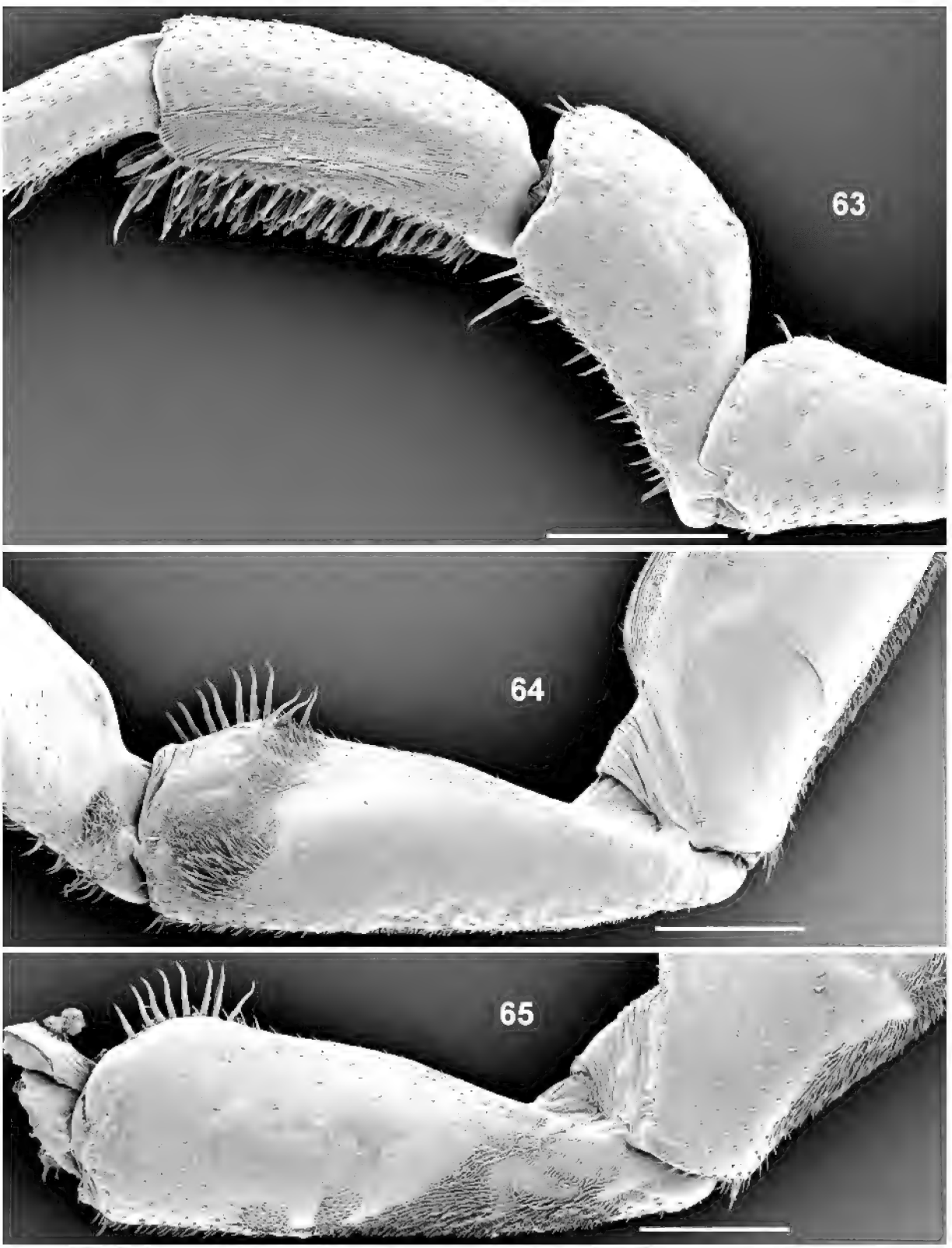
Figs. 52–58. *Armadillidium inflatum*, ♂, 11.0 × 6.0 mm, holotype (from SCHMALFUSS 1981). – **52**. Head, dorsocaudal view. **53**. Head, frontal view. **54**. Pereion-epimeron 1, lateral view. **55**. Telson and uropod in situ, dorsal view. **56**. Ischium 7, frontal view. **57**. Pleopod-exopodite 1, dorsal view. **58**. Apex of pleopod-endopodite 1.



Figs. 59–60. *Armadillidium irmengardis* (Tímfi Mountain, SMNS 2861), ♂, 19.5 × 9.0 mm. – **59**. Head and pereion-tergite 1, dorsal view. **60**. Head, dorsal view. – Scales: 0.5 mm.



Figs. 61–62. *Armadillidium irmengardis* (Tímfi Mountain, SMNS 2861). – **61**. ♂, 15.0 × 6.7 mm, head, frontal view. **62**. ♂, 19.5 × 9.0 mm, antenna. – Scales: 0.5 mm.



Figs. 63–65. *Armadillidium irmengardis* (Tímfi Mountain, SMNS 2861), ♂, 19.5 × 9.0 mm. – **63**. Pereiopod 1, frontal view. **64**. Ischium 7, frontal view. **65**. Ischium 7, caudal view. – Scales: 0.5 mm.

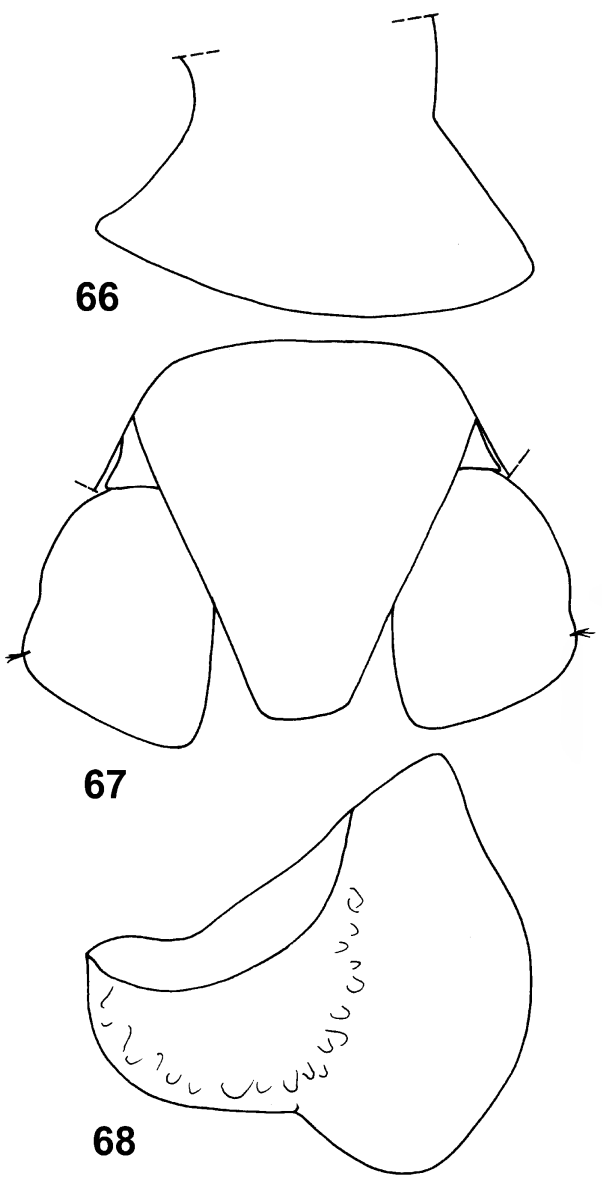
3.10 *Armadillidium irmengardis* Strouhal, 1956 (Figs. 59–68, map Fig. 69)

Literature records

Strouhal 1942: 149 (*A. irmengardae*, nomen nudum; GR, western mainland, province Epirus, southern part of the prefecture Ioánnina); Strouhal 1956: 608, figs. 36–42 (*A. irmengardis* n. sp.; localities as before); Sfenthourakis 1992: 159 (prefecture Ioánnina, Tímfi Mountain, 600 m).

Material examined

Greece: 14 ex., province Epirus, prefecture Ioánnina, Tímfi Mountain, Pápingo, leg. Kühnelt, 20.–22.VII.1968 (SMNS 1806, 1822). – 1 ex., as before, 1700–2000 m, leg. Osella, 1.VII.1982 (SMNS 1925). – 2 ex., as before, Tímfi Mountain, Orakólimni, 2250 m, leg. Sfenthourakis, 19.V.1990 (SMNS 2309). – 2 ex., as before, Tímfi Mountain, Víkos Gorge, leg. Sfenthourakis, 19.V.1990 (SMNS 2312). – 12 ex., as before, Tímfi Mountain, N of Skamnéli, 2000 m, leg. Bartsch, 24.VI.2005 (SMNS 2870). – 3 ex., as before, Tímfi Mountain, Klidoniá, 400 m, leg. Sfenthourakis, 30.V.2003 (SMNS 2861). – 2 ex., as before, Smolikás Mountain, Drakólimni, 2000–2500 m, leg. Bello & Osella, 10.VII.1983 (SMNS 2088). – 15 ex. (syntypes), southeastern part of prefecture Ioánnina, Xerovúni Mountain, Platanúsa, 800 m, leg. Beier, 5.VI.1933 (NMW).



Figs. 66–68. *Armadillidium irmengardis* (Tímfi Mountain, SMNS 2861), ♂, 19.5 × 9.0 mm. – **66**. Pereion-epimeron 1, lateral view. **67**. Telson and uropods in situ. **68**. Pleopod-exopodite 1, dorsal view.

Diagnostic characters

Maximum dimensions: 19.5 × 9.2 mm (Strouhal 1956).

Coloration: Dark gray, juveniles brownish, small yellowish spots on tergites.

Cuticular structures: Tergites smooth.

Frontal shield from behind slightly surpassing frontal margin, upper margin straight (Figs. 59–60); antennal lobes trapezoidal (Fig. 61). Hind margin of pereion-epimeron 1 with sharp angle (Fig. 66). Telson slightly longer than wide, with straight sides and truncate apex (Fig. 67). Flagellum of antenna in adults with segments of equal length (Fig. 62). Male pereiopod 1 with ventral brush of spines only on carpus (Fig. 63). Male ischium 7 ventrally very slightly convex, frontal side with distal hair-field, caudal side with proximal hairy areas, the same on medial margin of basipodite 7 (Figs. 64–65). Male pleopod-exopodite 1 with short triangular hind-lobe, medial margin slightly concave (Fig. 68), endopodite 1 with apex straight.

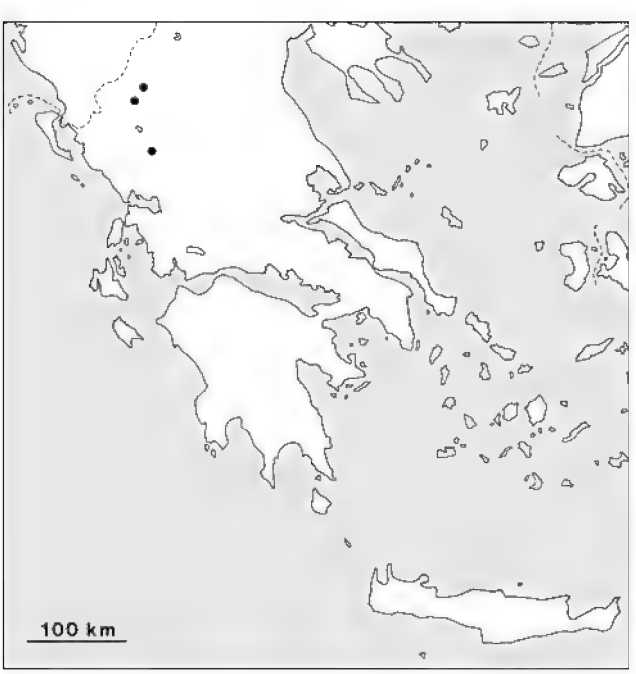
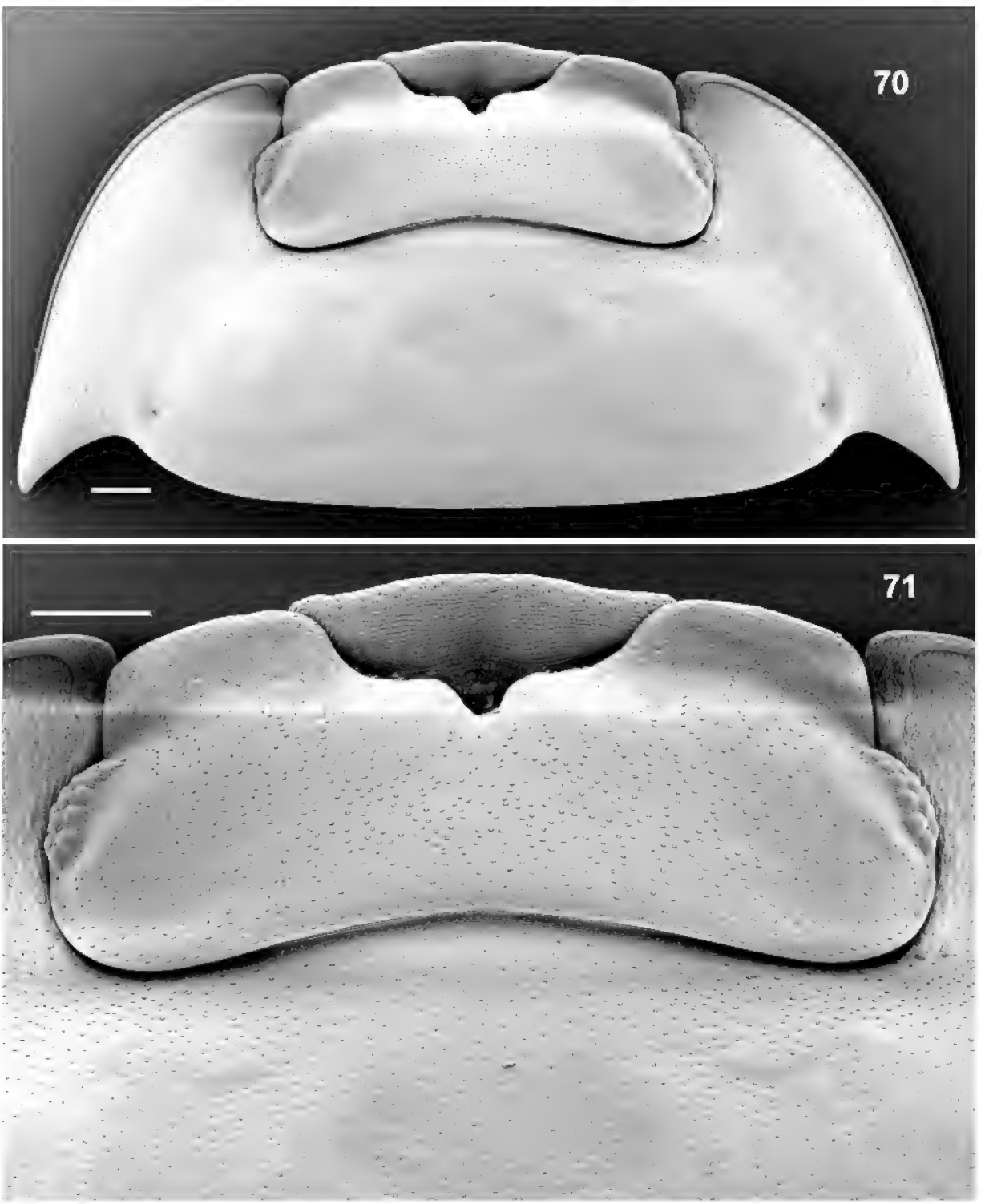
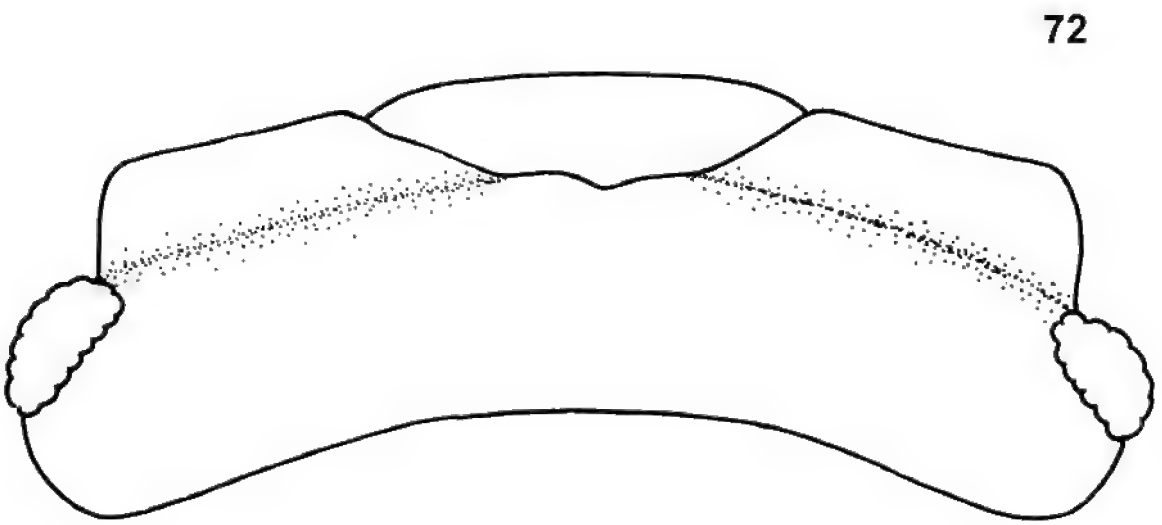
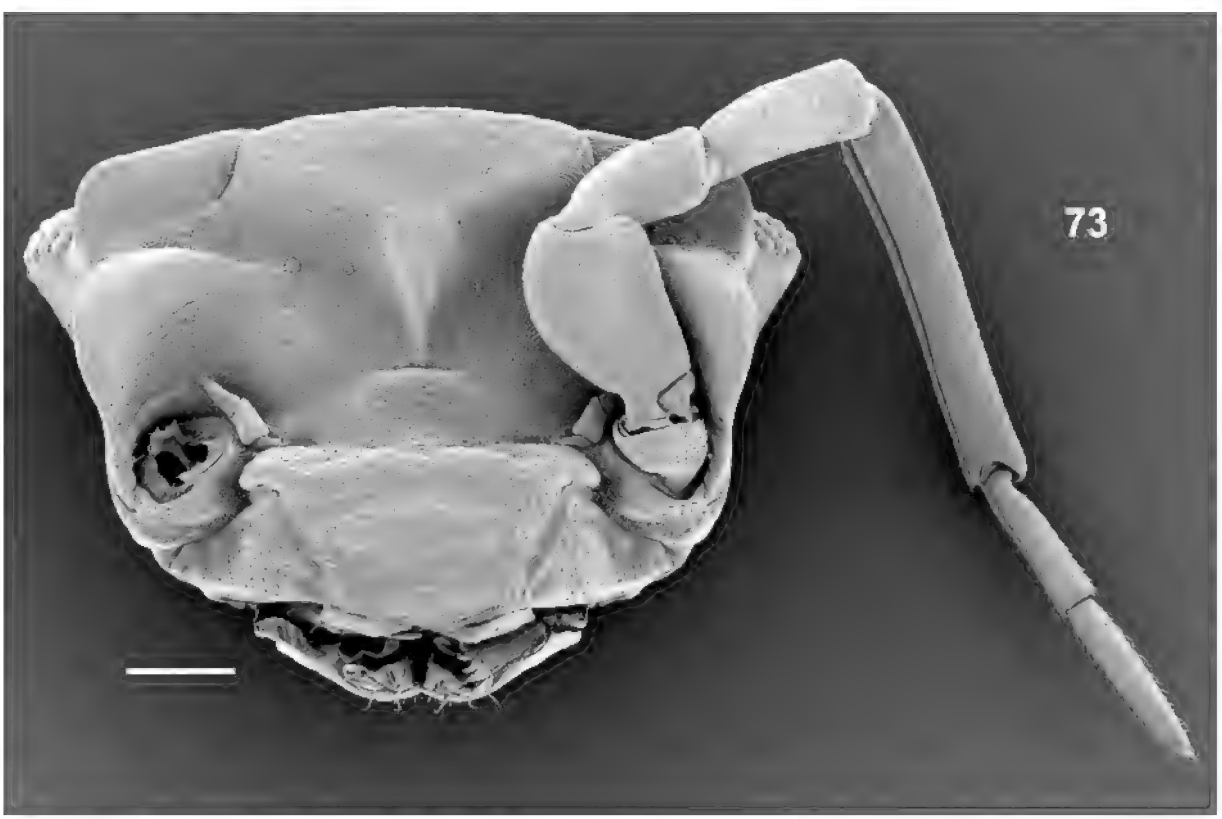


Fig. 69. Records of *Armadillidium irmengardis*.

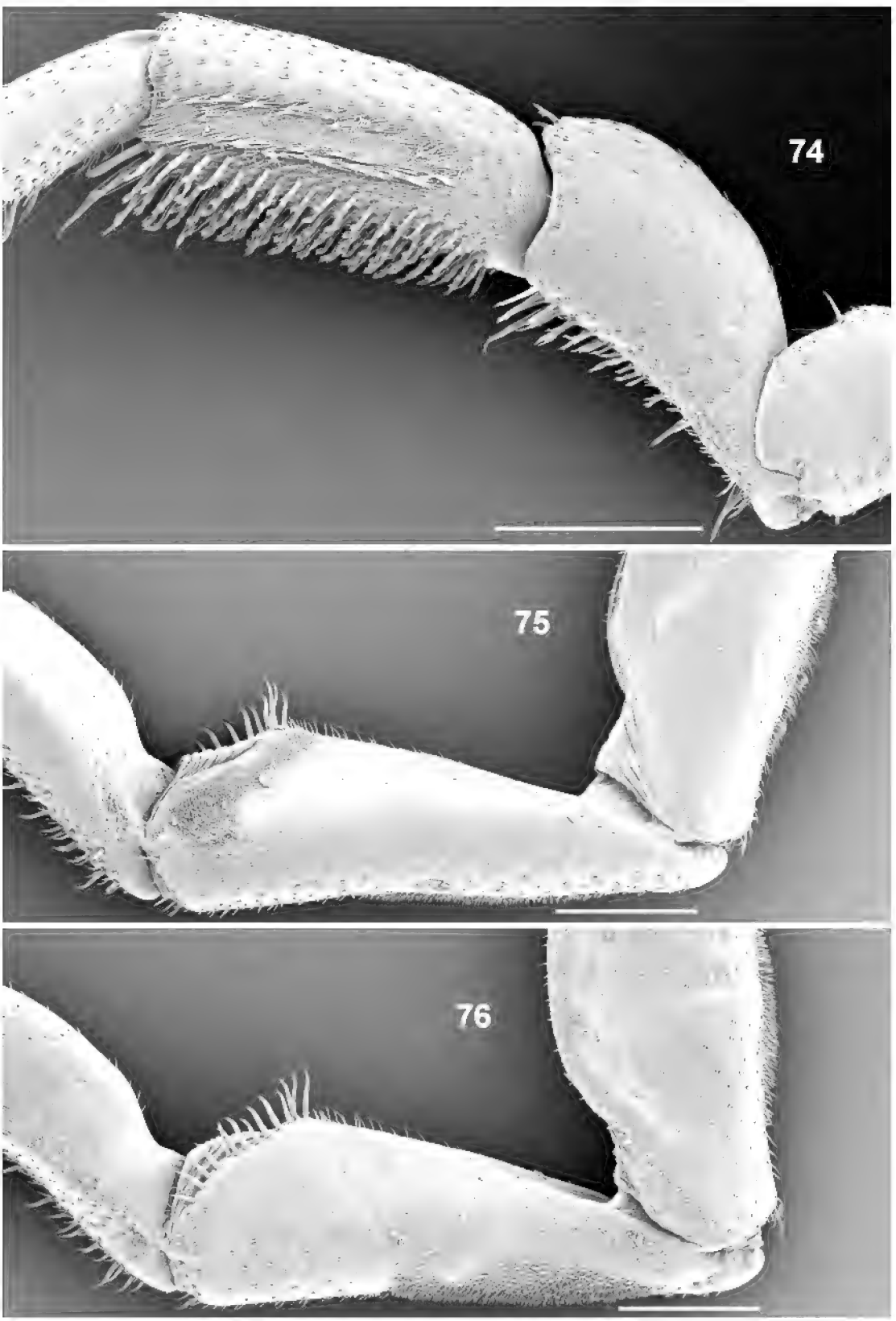


Figs. 70–71. *Armadillidium xerovunense* (Tímfi Mountain, SMNS 2870), ♂, 18.2 × 7.8 mm. – **70**. Head and pereion-tergite 1, dorsal view. **71**. Head, dorsal view. – Scales: 0.5 mm.





Figs. 72–73. *Armadillidium xerovunense*. – **72**. Nisísta, syntype (NMW), ♂, 13.5 × 7.0 mm, head, dorsal view. **73**. Tímfi Mountain (SMNS 2870), ♂, 16.3 × 7.5 mm, head, frontal view. – Scale: 0.5 mm.



Figs. 74–76. *Armadillidium xerovunense* (Tímfi Mountain, SMNS 2870), ♂, 18.2 × 7.8 mm. – **74**. Pereiopod 1, frontal view. **75**. Ischium 7, frontal view. **76**. Ischium 7, caudal view. – Scales: 0.5 mm.

Distribution (map Fig. 69)

Greece, western mainland, Epirus, prefecture Ioánnina.

3.11 *Armadillidium janinense* Verhoeff, 1902

The species has been treated in the 25th contribution of this series (Schmalfuss 2008). It is known from the western Greek mainland (Schmalfuss 2008: map fig. 34).

3.12 *Armadillidium peloponnesiacum* Verhoeff, 1901

This species was treated in the 23rd contribution of this series (Schmalfuss 2006a). It is known from western, central and southern Greece (Schmalfuss 2006a: map fig. 172).

3.13 *Armadillidium vulgare* (Latreille, 1804)

This species was again treated in the 23rd contribution of this series (Schmalfuss 2006a). It originated with great probability in southeastern Europe and has been transported by human activities to all parts of the world, where it thrives mostly in disturbed biotopes where the indigenous fauna was destroyed together with the original vegetation for agricultural reasons. A map of all Greek records is given in Schmalfuss (2006a).

3.14 *Armadillidium xerovunense* Strouhal, 1956 (Figs. 70–79, map Fig. 80)

Literature records

Strouhal 1942: 148 (*A. xerovunense*, nomen nudum; GR, western mainland, province Epirus, prefectures Ioánnina and Árta); Strouhal 1956: 587, figs. 3–8 (localities as before); Sfenthourakis 1992: 159 (prefecture Ioánnina, Tímfi Mountain, 1100–1900 m).

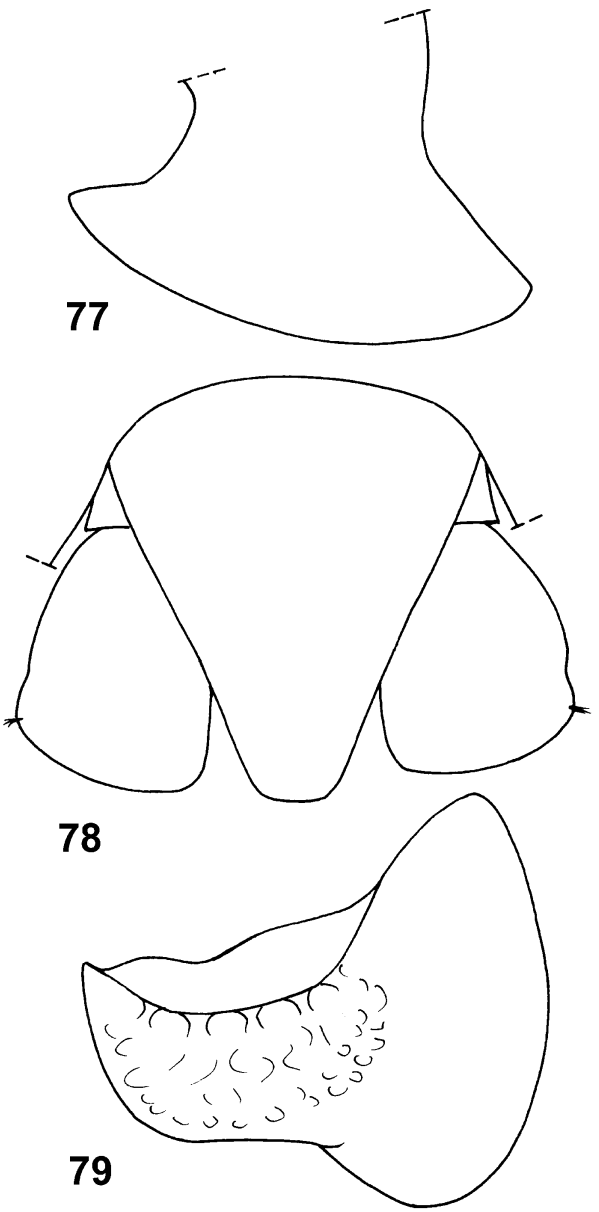
Material examined

Greece: 2 ex. (syntypes), province Epirus, northwestern prefecture Árta, Nisísta, 800 m, leg. Beier, 1.VI.1933 (NMW). – 2 ex., appendage preparations, southeastern prefecture Ioánnina, Platanúsa, 800 m, leg. Beier, 5.VI.1933 (NMW). – 3 ex., province Epirus, prefecture Ioánnina, Kalpáki, Véllas monastery, 400 m, leg. Kontschán, 12.V.2006 (SMNS 1390). – 2 ex., prefecture Ioánnina, Tímfi Mountain, 1500 m, leg. Sfenthourakis, V.1990 (SMNS 2310). – 3 ex., Tímfi Mountain, Pápingo, leg. Kühnelt, 20.VII.1968 (SMNS 1822). – 14 ex., as before, 1700–2100 m, leg. Osella, VII.1982 (SMNS 1924, 1925). – 4 ex., Tímfi Mountain, Skamnélli, 2000 m, leg. Bartsch, 24.VI.2005 (SMNS 2870). – 1 ex., prefecture Ioánnina, Smolikás Mountain, Drakolímni, 2000 m, leg. Bello, 8.VII.1983 (SMNS 2086).

Diagnostic characters

Maximum dimensions: 19.0 × 9.5 mm.

Coloration: Dark gray, with a central and two lateral rows of small whitish dots on tergites. Juveniles light brown. The type specimens from the southern Epirus (Xerovuni) are without pigmentation, but this may be due to long conservation.



Figs. 77–79. *Armadillidium xerovunense* (Tímfi Mountain, SMNS 2870), ♂, 18.2 × 7.8 mm. – **77**. Pereion-epimeron 1, lateral view. **78**. Telson and uropods in situ. **79**. Pleopod-exopodite 1, dorsal view.

Cuticular structures: Tergites very slightly granulated.

Frontal shield and lateral frontal lines forming a high ledge in caudal view (Figs. 70–72); antennal lobes semicircular (Fig. 73). Hind margin of pereion-epimeron 1 with rounded angle (Fig. 77). Telson longer than wide, with straight sides and truncate apex (Fig. 78). Flagellum of antenna in adults with distal segment slightly longer than proximal one (Fig. 73). Male pereiopod 1 ventrally with dense brush of spines only on carpus (Fig. 74). Male ischium 7 ventrally very slightly concave, frontal side with usual distal hair-field and with hair-field proximally on ventral part, basipodite 7 with dense hairy setae on medial side (Figs. 75–76, see also Remarks). Male pleopod-exopodite 1 with triangular hind-lobe (Fig. 79), endopodite 1 with apex straight.

Distribution (map Fig. 80)

Greece, western mainland, Epirus, prefectures Ioánnina and Árta.

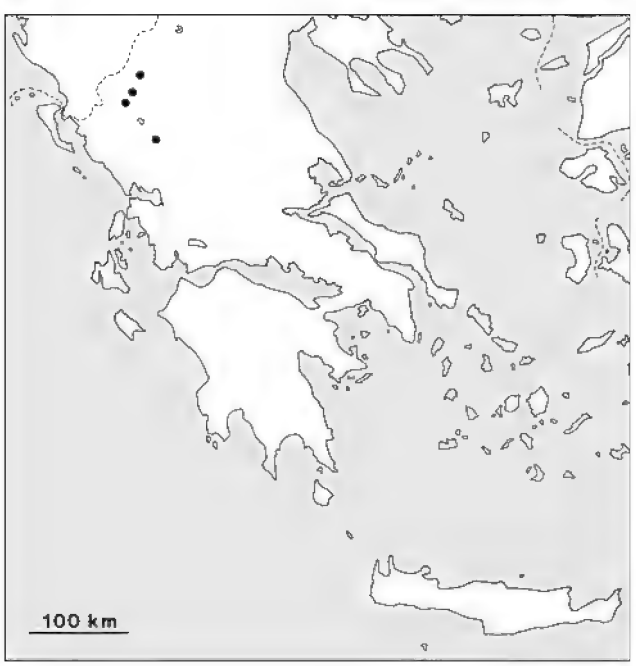


Fig. 80. Records of *Armadillidium xerovunense*.

Remarks

In the appendage preparation of the type specimens from the southern Epirus (Xerovúni region) the ventral and medial hair-fields in the ischium and basipodite of pereiopod 7 cannot be recognized (compare fig. 6, p. 588 in Strouhal 1956). Also in the males from the Tímfi Mountain these structures are difficult to see with the light microscope. Future SEM-investigations of new collections from the type localities should clarify the situation.

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Die *Unionicola*-Arten (Acari: Hydrachnidia) des temporären Flusses N'Zi in der Elfenbeinküste, Westafrika

The *Unionicola* species (Acari: Hydrachnidia) of the temporary river N'Zi in the Ivory Coast, West Africa

Jürgen Hevers

Abstract

From January 1977 to January 1978, 3293 Hydrachnidia of the genus *Unionicola* were captured at five rapids of the N'Zi, in monthly samples of one day drift and one night drift respectively. They belong to 12 species; the four most common species are *U. cooki*, *U. fimbriata*, *U. statzneri*, and *U. inflexa*, representing 85 % of the material.

For these four dominant species abundances could be calculated, and both their phenology and the adaptation to the varying discharge of the N'Zi were investigated. The lenitobiont species live in the stagnant or nearly stagnant parts of the river during the dry season. At the beginning of the rainy season (May to August), when the river starts flowing, they are gradually flushed out of the riverlakes, unless they had not previously entered into resting stages. In the main rainy season (September to October), they are not found in drift samples. With decreasing flow rates, the first adults emerge and appear in the drift before the main dry season. A comparison of day and night drift shows that the main activity starts after sunset.

Three species are described as new for science: *Unionicola (Armatax) bicornis* **n. sp.**, *U. (Pentatax) nziensis* **n. sp.**, and *U. (Pentatax) statzneri* **n. sp.** The descriptions of the other species are improved. Lectotypes are designated for *U. (Armatax) koenikei*, *U. (Pentatax) fimbriata*, *U. (Pentatax) megalopsis*, *U. (Pentatax) minuta*, *U. (Pentatax) vietsi*, *U. (Unionicola) inflexa*, and *U. (Unionicola) pollicigera*. *U. (Armatax) koenikei*, and the species of the *U. (Pentatax) borgerti*-group are revised.

Unionicola (Armatax) bicornis **n. sp.** is characterised by two thick, movably inserted setae on the anterior dorsal plates; it also possesses double-pointed hook-like processes situated laterally on the second and third coxal plates (thus belonging to the subgenus *Armatax*), and an additional process on the fourth coxal plate. The acetabular plates usually bear 10 acetabulae, and the variable palps are bearing two large prongs at the end.

Unionicola (Pentatax) nziensis **n. sp.** is a member of the *U. (Pentatax) borgerti*-group, which is characterised by its peculiarly broadened and remarkably large but blunt claws on the first pair of the legs, and a blunt tarsus of the palps without any tine at the end. The new species is similar to *U. vietsi* and *U. megalopsis*, but clearly differs by ratios and measurements.

Unionicola (Pentatax) statzneri **n. sp.** has an extraordinary strong ventral prong on the tarsus of the palps, and pectinate claws on the first to third pairs of the legs (in females also on the fourth pair). The fourth pair of legs possesses special modifications in the males.

Key words: Acari, Hydrachnidia, *Unionicola*, West Africa, Ivory Coast, phenology, activity rhythms, taxonomy, new records, new species, redescription, lectotypes.

Zusammenfassung

Von Januar 1977 bis Januar 1978 wurden an fünf Stromschnellen im N'Zi 3293 Individuen der Gattung *Unionicola* in monatlichen Proben von jeweils einer Tag- und einer Nachtdrift gefangen. Sie gehören 12 Arten an, die vier häufigsten Arten *U. cooki*, *U. fimbriata*, *U. statzneri* und *U. inflexa* stellen 85 % der Individuen.

Für die vier dominanten Arten konnten die Abundanzen in der Drift berechnet werden, die Aussagen zur Phänologie und die Anpassungen an den stark schwankenden Abfluss des N'Zi ermöglichen. Die limnophilen Arten leben in den stehenden oder fast stehenden Flussabschnitten während der Trockenzeit und werden bei Beginn der Regenzeit (Mai–August) mit dem Einsetzen des Abflusses nach und nach aus diesen Flussseen ausgeschwemmt, soweit sie nicht zuvor in Ruhestadien eingetreten sind. In der Hauptregenzeit (September–Oktober) sind sie nicht mehr in der Drift enthalten. Mit abnehmender Fließgeschwindigkeit schlüpfen dann wieder die ersten Tiere und erscheinen noch vor der Haupttrockenzeit wieder in der Drift. Der Vergleich von Tag- und Nachtdrift zeigt, dass die Hauptaktivitätszeiten nach Sonnenuntergang liegen.

Drei Arten werden als neu für die Wissenschaft beschrieben: *Unionicola (Armatax) bicornis* **n. sp.**, *U. (Pentatax) nziensis* **n. sp.** und *U. (Pentatax) statzneri* **n. sp.** Die Beschreibungen der übrigen Arten werden wesentlich ergänzt. Für *U. (Armatax) koenikei*, *U. (Pentatax) fimbriata*, *U. (Pentatax) megalopsis*, *U. (Pentatax) minuta*, *U. (Pentatax) vietsi*, *U. (Unionicola) inflexa* und *U. (Unionicola) pollicigera* werden Lectotypen festgelegt. Revisionen von *U. (Armatax) koenikei* und der *U. (Pentatax) borgerti*-Gruppe schließen sich an.

Unionicola (Armatax) bicornis **n. sp.** hat an den 2. und 3. Coxalplatten lateral kräftige doppelte Hakenfortsätze (= Kennzeichen der Untergattung *Armatax*) und an den 4. Coxalplatten einen kleineren Fortsatz (Abb. 30, 59). Einzigartig für diese Art innerhalb der Gattung *Unionicola* sind zwei kräftige, beweglich eingelenkte Chitinzapfen auf den vorderen Chitinplatten der Dorsalseite des Idiosoma. Die Napfplatten tragen in der Regel 10 Näpfe und die variablen Palpen am letzten Glied zwei mächtige Zähne.

Unionicola (Pentatax) nziensis **n. sp.** gehört zur *U. (Pentatax) borgerti*-Gruppe mit ihren eigentümlich verbreiterten, auffallend großen, aber stumpfen Krallen am 1. Beinpaar und den stumpfen Spitzen der Palpen ohne jegliche Zähne. Sie ähnelt *U. vietsi* und *U. megalopsis*, ist aber von diesen beiden Arten eindeutig durch Maße und Verhältnisse zu unterscheiden.

Unionicola (Pentatax) statzneri **n. sp.** hat einen außerordentlich kräftigen Beugeseitenzahn am letzten Palpen-Glied und kammartige Krallen am 1. bis 3. Beinpaar (bei den ♀♀ auch am 4. Beinpaar). Die ♂♂ zeigen auffällige sekundäre Geschlechtsmerkmale am 4. Beinpaar.

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1 Einleitung

Aus Afrika liegen bisher kaum quantitative Untersuchungen zur Wassermilben-Fauna vor. Böttger (1975) nahm erste quantitative Benthosproben aus zentralafrikanischen Bergbächen, deren Milben K. O. Viets systematisch bearbeitete (K. O. Viets & Böttger 1974). In Westafrika wurde bislang nur qualitativ gesammeltes Wassermilben-Material bearbeitet, besonders umfangreiches von K. Viets (1912, 1913/14, 1916, 1925) aus Kamerun, Walter (1935) aus dem damaligen Französisch-Westafrika und Cook (1966) aus Liberia. Einen Überblick geben K. O. Viets (1970) für das gesamte Afrika und Smit (1994) für Westafrika.

Im Rahmen eines WHO-Projektes zur Bekämpfung der Onchozerkose (Flussblindheit), einer chronischen Krankheit des Menschen, die durch Kriebelmücken (Diptera: Simuliidae) als Zwischenwirt der ursächlichen Filarie übertragen wird, wurden u. a. 1977/78 in großem Maßstab Fließgewässerproben im temporären Fluss N'Zi der Elfenbeinküste in Westafrika genommen. Dr. Bernhard Statzner, jetzt Lyon-Villeurbanne (Frankreich), war damals Teilnehmer an dem Projekt und konnte so über 13 Monate quantitative Driftproben im N'Zi nehmen und dabei auch die Wassermilben separieren (vgl. Statzner 1982, 1984).

Von fünf Stromschnellen des N'Zi liegen somit Fänge vor, die 265 km dieses temporären Flusses erfassen. Durch den vollen Jahreszyklus in der vom Wechsel zwischen Regenzeit und Trockenzeit geprägten Landschaft sind Aussagen zum Entwicklungszyklus einzelner Arten und zu ihrer Anpassung an die extrem unterschiedlichen Abflussmengen möglich.

Es wurde mit nur wenigen Stunden Abstand monatlich jeweils eine Driftprobe vor Sonnenuntergang und eine nach Sonnenuntergang genommen. Der Vergleich dieser Tag- und Nachtdrift zeigt deutliche Unterschiede, die auf Aktivitätszeiten der Wassermilben schließen lassen.

Ein so umfangreiches, über einen so langen Zeitraum kontinuierlich gesammeltes quantitatives Wassermilben-Material hat bislang aus Afrika nicht vorgelegen. Insgesamt wurden über 5000 Tiere gefangen, von denen über die Hälfte zur Gattung *Unionicola* gehört.

Drei neue *Unionicola*-Arten können beschrieben und die Diagnosen der übrigen neun Arten wesentlich ergänzt werden. Dazu war auch die Revision nahe verwandter Arten erforderlich (siehe Kap. 5).

Dank

Herzlicher Dank gebührt vor allem Dr. Bernhard Statzner, Direktor am CNRS in Villeurbanne, Frankreich, der das vorliegende Material im Rahmen seiner Projektarbeiten vor 30 Jahren in der Elfenbeinküste gesammelt hat. Ihm danke ich auch für Informationen zu den Fangumständen und für Literaturhinweise zum dortigen Onchocerciasis Control Programme.

Vergleichsmaterial und vor allem Typusmaterial haben freundlicherweise ausgeliehen: das Forschungsinstitut Senckenberg in Frankfurt a. M. (zunächst Dr. Manfred Grasshoff und Ulrike Mückenheim, zuletzt Dr. Peter Jäger und Julia Altmann), das Naturhistorische Museum Basel und das Instituut voor Taxonomische Zoölogie des Zoölogisch Museum in Amsterdam (durch freundliche Vermittlung von Drs. Harry Smit, Alkmaar). Prof.

Dr. Reinhard Gerecke, Tübingen, entdeckte verloren geglaubte Präparate von Eugen von Daday (1855–1920) in Basel, darunter das Typuspräparat von *U. borgerti*, und vermittelte die Ausleihe.

Posthum habe ich einen großen Dank abzustatten Herrn Dr. Dr. h. c. Kurt O. Viets (1910–1995), Wilhelmshaven, der mir u. a. unpräparierte Milbenproben seines Vaters Dr. h. c. Karl Viets (1882–1961) aus Kamerun von 1911 überließ und mir seinerzeit wertvolle Auskünfte und Rat zu dieser Arbeit erteilte. Ebenso unterstützte Dr. Carl Bader (1910–1997), Basel, den Beginn dieser Arbeiten, indem er mir selbstlos seine akribisch zusammengetragene umfangreiche Abbildungssammlung afrikanischer Hydrachnidia kopierte.

Zur Verbesserung des Manuskriptes haben als Gutachter Prof. Dr. Reinhard Gerecke, Tübingen, und Dr. Peter Martin, Kiel, wesentlich beigetragen. Für die sachkundige, konstruktive Kritik und die aufgewendete Mühe danke ich sehr.

2 Untersuchungsgebiet, Material und Methode

Untersuchungsgebiet

Die untersuchten Proben wurden im Rahmen des Onchocerciasis Control Programme (OCP) der Weltgesundheitsorganisation (WHO) 1977/78 in der Elfenbeinküste Westafrikas genommen. Das OCP von 1974 bis 2002 hatte zum Ziel, die menschliche Onchozerkose (Flussblindheit) zu eliminieren. Die Onchozerkose wird ausgelöst durch die Knäuelfilarie *Onchocerca volvulus* (Nemathelminthes: Nematoda), deren Zwischenwirt und Überträger Kriebelmücken des *Simulium damnosum* Komplexes (Diptera: Simuliidae) sind.

Da zu Beginn bis 1990 kein Medikament für eine Massentherapie der Bevölkerung gegen die Knäuelfilarie zur Verfügung stand, blieb als einzige Strategie die Unterbrechung des Übertragungszyklus durch die Bekämpfung der in Fließgewässern lebenden Larvenstadien der Kriebelmücken. Ab 1974 wurden zunächst großräumig Fließgewässer vom Hubschrauber aus mit dem Insektizid Abate behandelt. Daneben sollten aber auch weitere und neuere Insektizide erprobt und deren Erfolg entomologisch und epidemiologisch kontrolliert werden (Grunewald 2003, Lévêque et al. 2003, Resh et al. 2004).

Der temporäre Fluss N'Zi in der Elfenbeinküste wurde für eine Langzeit-Felduntersuchung von Dezember 1976 bis März 1978 ausgewählt, um die Wirkung regelmäßiger Ausbringung des damals neuen Insektizids Chlorphoxim der Firma Bayer gegen die Larven von *Simulium damnosum* auf die übrige aquatische Fauna zu ermitteln.

Der N'Zi ist ein Nebenfluss des Bandama und fließt von Nord nach Süd (Abb. 1). In der Regenzeit beginnt er südlich von Ferkéssédougou (= Ferké) und erreicht den Bandama stark mäandrierend nach 400 km Luftlinie nördlich von Tiassalé, erstreckt sich also vom 6. bis zum 10. nördlichen Breitengrad.

Die fünf Untersuchungsstationen (mit dem Auto erreichbare Stromschnellen bei Tinbé, Fetekro, Ouokoukro, Kolomikro und Bocanda) lagen im mittleren Bereich des N'Zi; die nördlichste bei Tinbé ist etwa 265 km Flussstrecke (140 km Luftlinie) von der südlichsten bei Bocanda entfernt. In diesem Abschnitt fließt der N'Zi durch Savanne. Die Ufer waren größtenteils mit anthropogen weitgehend unbeeinflusstem Galeriewald bestanden, mit nur kleinen kultivierten Bereichen. Nur in zwei Regionen lagen große Plantagen: um M'Bahiakro für Reis und um Kolomikro für Baumwolle.

Die Klimaunterschiede im Jahresgang werden im Untersuchungsgebiet vor allem vom Wechsel zwischen Regen- und Trockenzeit geprägt, während die Lufttemperatur z. B. in Bouaké relativ konstant bei einer mittleren Jahrestemperatur von 26 °C liegt (Abb. 2, Walter & Lieth 1960). Das Abflussmuster 1977/78 an den Stromschnellen der fünf Untersuchungsstationen war das Gleiche. Der Abfluss fiel zuerst im Norden ab Februar und später auch im Süden bis Anfang April auf Null. In der letzten Aprilwoche 1977 begann der Fluss wieder zu fließen, der Abfluss erreichte einen Höhepunkt im Juni und wurde danach wieder schwächer. Ende August begann die Hauptregenzeit, und der Abfluss erreichte im September und Oktober sein jährliches Maximum. Mit Beginn der Trockenzeit Ende Oktober nahm der Abfluss wieder ab und versiegte schließlich in der nördlichen Station im Februar 1978.

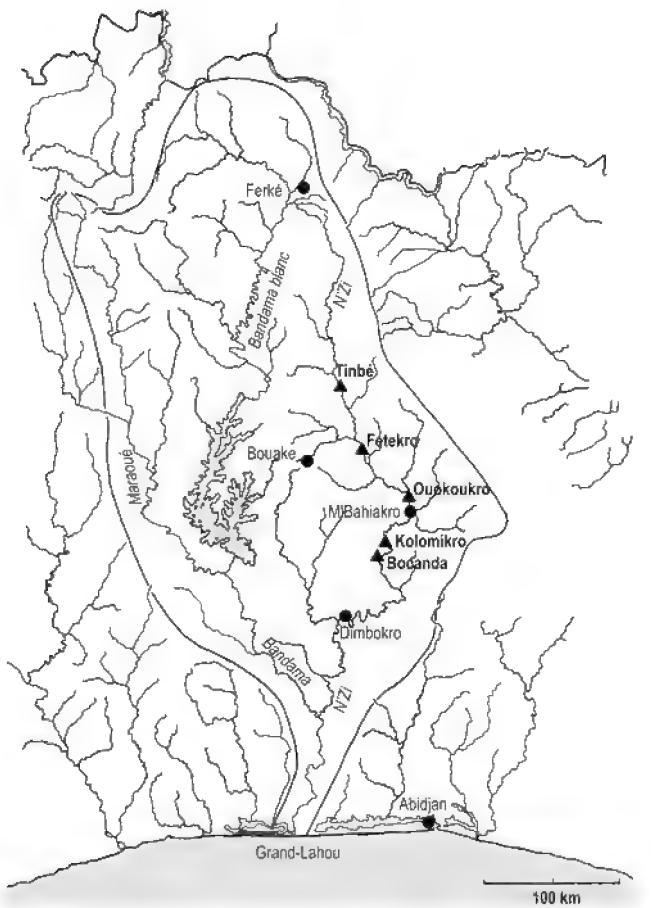

Abb. 1. Das Einzugsgebiet des Bandama in der Elfenbeinküste Westafrikas mit seinem größten Nebenfluss, dem N'Zi, zur Hauptregenzeit, wenn alle Flüsse Wasser führen. Eingezeichnet sind als Dreiecke die fünf Untersuchungsstationen an Wasserfällen am Mittellauf des N'Zi.

Nach den chemischen Daten, dem Boden, der Vegetation und den Niederschlägen ist der N'Zi im Wesentlichen ein typischer Weißwasserfluss im Sinne von Sioli (1965, 1975). Die pH-Werte lagen im Untersuchungsgebiet zwischen 7,0 und 7,5.

Die Abflussdaten des N'Zi über 16 Jahre (1954–1970) zeigen große Schwankungen von Jahr zu Jahr (Camus 1971). Die monatlichen Mittel dieser 16 Jahre unterscheiden sich von den

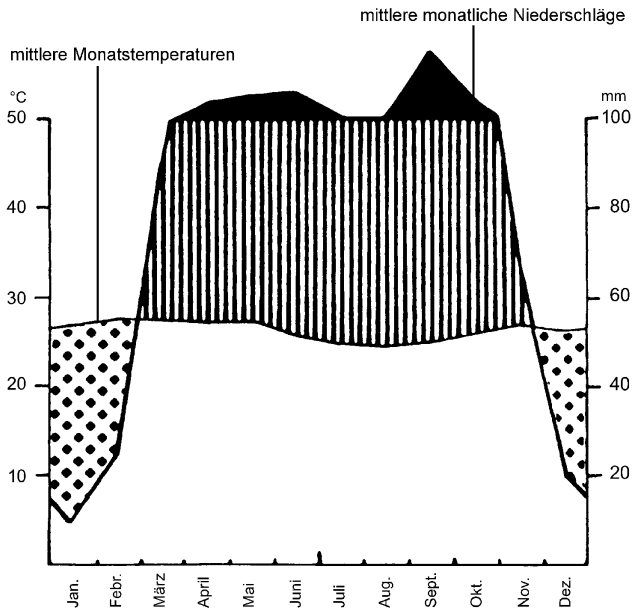

Abb. 2. Klimadiagramm für Bouaké (= Buake, 387 m über NN), 40 km westlich des N'Zi auf Höhe der Untersuchungsstation Fetekro. Die mittlere Jahrestemperatur beträgt 26 °C mit geringen Schwankungen der Monatsmitteltemperaturen. Die Niederschläge mit einem mittleren jährlichen Niederschlag von 1271 mm fallen in einer ausgeprägten Regenzeit, die von März bis Anfang November dauer, mit teilweise deutlich über 100 mm Niederschlag im Monat (gestreift: humide Jahreszeit, gepunktet: Dürrezeit). – Nach WALTER & LIETH (1960).

Abflüssen des Untersuchungszeitraumes 1977 erheblich durch das Fehlen der Abnahme von Juni bis August. Nach den Mittelwerten sollte der Abfluss kontinuierlich von März bis zur Regenzeit zunehmen.

Aus den hydrologischen Daten ergibt sich, dass der N'Zi nur in der Regenzeit ein durchgehender Fluss ist. Fällt der Abfluss, wird der Fluss in eine Anzahl von Seen unterteilt, verbunden durch Stromschnellen, die dann kurze Seeausflüsse und Seeeinflüsse darstellen. Wenn der Fluss aufhört zu fließen, bleiben die Seen übrig, was z. B. die Wassertemperatur und die Sichttiefe deutlich beeinflusst.

Material und Methode

An den fünf Untersuchungsstationen wurden von Januar bis November 1977 einmal im Monat und dann noch einmal im Januar 1978 u. a. Driftproben genommen. Dabei wurden die Netze jeweils beginnend zwei Stunden vor Dunkelheit für 30 Minuten exponiert (Tagdrift) und 1,5 Stunden nach Dunkelheit für 3 Minuten (Nachtdrift). Ausgebracht wurden jeweils drei parallele Driftnetze mit je 25 × 25 cm Öffnungsweite, die auf den Grund aufgesetzt wurden. Im September und Oktober während der stärksten Abflüsse jedoch wurden die Netze eben unterhalb der Wasseroberfläche von Brücken oder einem Boot aus exponiert.

Aus diesen Driftproben wurden die Hydrachnidia quantitativ ausgelesen und separiert. Die Maschenweite der Driftnetze betrug normalerweise 320 × 200 µm. Durch Stömungsmessungen vor jeder Netzöffnung wurde die filtrierte Wassermenge berechnet, um die Individuendichte (Ind./m³) ermitteln zu können.

1974 begann die Ausbringung von Insektiziden gegen die Larven der Simuliidae mit Abate 200 CE der Firma PROCIDA nördlich von Tinbé. Die eigentlichen Untersuchungen mit Chlorphoxim begannen mit dessen Ausbringung ab dem 14.VI.1977 bei Tinbè und ab dem 28.VI.1977 bei Kolomikro und Bocanda, jeweils bis zum 14.XII.1977. Der dazwischen liegende Bereich mit Fetekro und Ouokoukro diente als unbegifteter Kontrollbereich (Einzelheiten bei STATZNER 1982).

Die Hydrachnidia in der Drift waren fast alle schwimmende Arten, die aus den stehenden Bereichen kamen. Die Wirkung der Ausbringung von Chlorphoxim nahe den Stromschnellen auf die Fauna in den langen Flussseen war gering. Der Prozentsatz der Organismen in einem Flusssee, der mit dem Insektizid in Berührung kam, war offenbar sehr klein. Daher reduzierte die Ausbringung die Seefauna nicht merklich (STATZNER 1982).

Systematik

In der Systematik werden zum Vergleich der Maße der Extremitätenglieder in ausgewählten Fällen Proportionalitätsdiagramme (ratio diagrams) erstellt (Abb. 24, 88, 209). In ihnen werden Proportionalitätskurven von Tieren, Tiergruppen oder Arten miteinander verglichen. Diese Kurven stellen die prozentualen Abweichungen der Längen der Extremitätenglieder von denen der entsprechenden Glieder einer zuvor ausgewählten Gruppe (Null-Gruppe) dar (HEVERS 1977).

Aus dem Vergleich der Kurven lassen sich Schlüsse auf Artzugehörigkeiten von Populationen ziehen, wobei ♂♂ und ♀♀ wegen eventueller Geschlechtsdimorphismen in getrennten Kurven betrachtet werden sollten. Kurven von Tieren oder Tiergruppen derselben Art müssten in etwa parallel zueinander verlaufen, da die Proportionen der Extremitätenglieder zueinander in etwa gleich sein müssten. Dieses Verfahren wurde schon verschiedentlich mit Erfolg angewendet (CROWELL & DAVIDS 1979; HEVERS 1977, 1978b, 1984; SMIT 1994, 1996).

Abkürzungen

I.[II., III., IV.]B.	1.[2., 3., 4.] Bein
I.B.2[3, 4, usw.]	2.[3., 4., usw.] Glied des 1. Beins
II.[III., IV.]Cp.	2.[3., 4.] Coxalplatte
III.+IV.Cp.	verwachsene 3. und 4.Coxalplatten
B	Breite
L	Länge
n	Anzahl
Np.	Napfplatten
P.2[3, 4, usw.]	2.[3., 4., usw.] Palpenglied
Präp.	Präparat

Sammlungs-Abkürzungen

NHMB	Naturhistorisches Museum, Basel
SMF	Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt a. M.
ZMAN	Instituut voor Taxonomische Zoölogie, Zoölogisch Museum, Amsterdam

3 Biologie

Allgemeines

Mit den Driftproben wurden insgesamt 5162 Hydrachnidia erfasst (Tab. 1), von denen allein 3293 (63,8 %) der Gattung *Unionicola* in 12 Arten angehörten, die damit die bei weitem individuenstärkste Gattung war. Die Fänge umfassen einen vollen Jahreszyklus von monatlich einer Tag- und einer Nachdrift. Die Untersuchungsstationen erfassen 265 Flusskilometer des mittleren N'Zi.

Die vier häufigsten Arten sind mit 2803 Tieren vertreten, das sind 85,1 % der *Unionicola*-Arten und 54,3 % aller Hydrachnidia. Mit diesen dominanten Arten lassen sich Berechnungen zur Phänologie durchführen, die Aussagen zur Anpassung der Arten an das Wasserregime des N'Zi zulassen.

Tab. 1. Die 1977/78 im N'Zi an den fünf Untersuchungsstationen gesammelten Hydrachnidia, in Klammern jeweils die im Fang enthaltenen Milben der Gattung *Unionicola*. Es sind die Tage angegeben, an denen jeweils ein Fang in der Tagdrift und der Nachtdrift erfolgte. In der Trockenzeit hörte der N'Zi von Nord nach Süd fortschreitend auf zu fließen, sodass Fänge im Februar und März nur teilweise und im April keine Driftfänge möglich waren. Aus dem Monat Dezember 1977 liegen dagegen aus organisatorischen Gründen keine Milbenfänge vor.

Tinbé			**Fetekro**			**Ouokoukro**		
Datum	Tagdrift	Nachtdrift	Datum	Tagdrift	Nachtdrift	Datum	Tagdrift	Nachtdrift
12.I.1977	51 (22)	90 (3)	13.I.1977	33 (9)	58 (7)	27.I.1977	13 (1)	169 (6)
–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–	–
4.V.1977	317 (264)	85 (76)	5.V.1977	14 (14)	41 (35)	11.V.1977	203 (159)	111 (86)
1.VI.1977	82 (82)	250 (237)	2.VI.1977	34 (34)	114 (107)	18.VI.1977	241 (191)	94 (69)
11.VII.1977	10 (6)	122 (117)	12.VII.1977	15 (8)	70 (44)	8.VII.1977	80 (15)	89 (11)
17.VIII.1977	7 (3)	76 (70)	16.VIII.1977	5 (2)	59 (56)	9.VIII.1977	35 (12)	36 (5)
12.IX.1977	88 (65)	–	13.IX.1977	2 (1)	–	–	–	–
10.X.1977	3 (0)	–	6.X.1977	–	5 (3)	–	–	–
7.XI.1977	7 (0)	–	8.XI.1977	4 (0)	23 (0)	10.XI.1977	6 (0)	18 (0)
–	–	–	–	–	–	–	–	–
9.I.1978	4 (4)	33 (14)	13.I.1978	16 (16)	–	10.I.1978	13 (4)	102 (8)
Summe	569 (446)	656 (517)	Summe	123 (84)	370 (252)	Summe	591 (382)	619 (185)

Kolomikro			**Bocanda**		
Datum	Tagdrift	Nachtdrift	Datum	Tagdrift	Nachtdrift
26.I.1977	93 (78)	115 (32)	25.I.1977	63 (40)	48 (8)
16.II.1977	9 (5)	32 (25)	15.II.1977	5 (2)	29 (15)
–	–	–	14.III.1977	3 (0)	92 (41)
–	–	–	–	–	–
10.V.1977	293 (105)	157 (69)	9.V.1977	49 (9)	191 (181)
7.VI.1977	447 (420)	56 (54)	6.VI.1977	47 (41)	135 (130)
17.VII.1977	9 (6)	41 (29)	6.VII.1977	4 (2)	13 (5)
10.VIII.1977	26 (20)	102 (28)	11.VIII.1977	81 (65)	–
–	–	–	14.IX.1977	20 (9)	2 (0)
13.X.1977	–	8 (0)	12.X.1977	5 (0)	3 (0)
9.XI.1977	1 (0)	4 (0)	16.XI.1977	–	7 (0)
–	–	–	–	–	–
12.I.1978	–	28 (7)	11.I.1978	–	19 (1)
Summe	875 (634)	543 (244)	Summe	273 (168)	543 (381)

Tagdrift: 2431 (1714) Hydrachnidia
Nachtdrift: 2731 (1579) Hydrachnidia

insgesamt: 5162 (3293) Hydrachnidia

Die vier am häufigsten im N'Zi gefangenen *Unionicola*-Arten waren: *Unionicola (Armatax) cooki* (469 ♂♂, 667 ♀♀, 217 Nymphen), *U. (Pentatax) fimbriata* (95 ♂♂, 394 ♀♀), *U. (Pentatax) statzneri* (226 ♂♂, 175 ♀♀, 52 Nymphen) und *U. (Unionicola) inflexa* (203 ♂♂, 301 ♀♀, 4 Nymphen).

Alle vier Arten sind gute Schwimmer mit langen Schwimmborsten insbesondere an den 3. und 4. Beinpaaren. Sie sind daher limnophile Arten, deren Lebensraum eher stehende als fließende Gewässer sind. Ihre Entwicklungsbedingungen sind in den während der Trockenzeit langsam zum Stehen kommenden Flussabschnitten besser als im stark fließenden Fluss, in dem sie und ihre Beutetiere stets von Verdriftung bedroht sind.

Die Arten der Gattung *Unionicola* sind generell gegenüber den übrigen Hydrachnidia dadurch ausgezeichnet, dass ihre Ruhestadien mit Tieren anderer Stämme vergesellschaftet sind. Die beiden Ruhestadien zwischen Larve und Nymphe und Nymphe und Adultus werden in allen bekannten Fällen obligatorisch in Mollusken (Bivalvia, Gastropoda) oder Schwämmen (Porifera: Spongillidae) durchlaufen. Auch die Eier entwickeln sich nur, wenn sie in Mollusken-Gewebe bzw. Schwämme abgelegt werden (Böttger 1972 Hevers 1980, Gledhill & Vidrine 2002).

Ein Teil der Arten mit Ruhestadien in Mollusken lebt auch als Nymphe und Adultus in ihnen, höchstwahrscheinlich parasitisch. Die übrigen Arten sind als Nymphe und Adultus freilebend und ernähren sich räuberisch, überwiegend von Crustaceen (Cladocera, Copepoda, nicht Ostracoda), sie nehmen aber auch z. B. Chironomiden-Larven an (Böttger 1970, Hevers 1980).

Die freilebenden Arten sind gute bis sehr gute Schwimmer, deren lange Beine vielfach dicht mit langen Schwimmborsten besetzt sind und so durch eine Fallschirmwirkung den Sinkwiderstand erhöhen. Sie können, nur in Abständen mit den Beinen schlagend, sich im Wasser schwebend halten. Sie gehören damit wie viele Cladoceren und Copepoden zum Plankton stehender Gewässer, deren Eigenbewegung jedoch nicht ausreicht, sich von der Wasserbewegung unabhängig zu machen.

Die Larven der Hydrachnidia sind fast stets Parasiten an Insekten und können dabei von ihren Wirten teilweise über große Distanzen verbreitet werden. Soweit bekannt, parasitieren die Larven von *Unionicola* an Zuckmücken (Diptera: Nematocera: Chironomidae) (Böttger 1972; Hevers 1978c, 1980).

Aktivitätszeiten

Die Drift limnischer Arten ist in der Regel kein aktiver, gerichteter Prozess zum Zwecke der Ortsveränderung, sondern die Tiere werden meist passiv von der Strömung erfasst. Dies wird jedoch wesentlich beeinflusst von der Aktivität der Tiere, da ein aktives Tier eher von der Strömung erfasst wird als ein ruhendes (Brittain & Eikeland 1988).

Selbst für Fließwasserorganismen, die in Morphologie und Verhalten an die Strömung angepasst sind, zeigt die Drift einen dem Positionswechsel der Tiere entsprechenden Tagesrhythmus (Müller 1966). Sie steigt sprunghaft an, sobald die Lichtintensität einen kritischen Wert unterschritten hat, und sinkt dann in der Nacht langsam und am Morgen rasch auf einen Wert ab, der für die Tagdrift in Fließgewässern kennzeichnend ist (Schwoerbel & Brendelberger 2005).

Diesen Tag-Nacht-Rhythmus zeigten auch die Driftproben im N'Zi sehr deutlich. Sie wurden jeweils im Zeitraum von nur 3,5 Stunden genommen (2 Stunden vor und 1,5 Stunden nach Sonnenuntergang), in dem sich die Abflussbedingungen nicht geändert hatten. Trotzdem waren die Abundanzen pro m³ filtriertes Wasser bei den vier häufigsten oben genannten *Unionicola*-Arten im Gesamtzeitraum Januar–November 1977 in der Nachtdrift im Durchschnitt 6,4fach höher als in der Tagdrift (*U. cooki*-Adulti 8,5fach, *U. cooki*-Nymphen 2,6fach, *U. fimbriata*-Adulti 3,9fach, *U. statzneri*-Adulti 7,4fach, *U. inflexa*-Adulti 6,7fach).

Das zeigt, dass die Aktivitäten aller vier Arten nach Sonnenuntergang wesentlich stärker sind als am Tage. Die freilebenden *Unionicola*-Arten leben als Nymphen und Adulti räuberisch vor allem von Cladocera und Copepoda. Sie müssen von ihren Beutetieren berührt werden, um sie dann blitzschnell vor allem mit dem 1. Beinpaar und den Pedipalpen zu ergreifen (Hevers 1980). Die Beute wird also nicht optisch, sondern taktil wahrgenommen. Für den Beutefang wird daher kein Licht benötigt, er kann nachts erfolgen.

Freundlieb (1979) beobachtete in einem Seeausfluss in Norddeutschland für *U. (Unionicola) crassipes* (Müller, 1776) ganz entsprechende Aktivitätszeiten. Die limnophile Art kam zu 60 % in der Drift von 18–24 Uhr vor. In diese Zeit fielen die Dämmerung und die ersten Nachtstunden.

Einige rheobionte Hydrachnidia-Arten wurden allerdings in Bächen Deutschlands vorwiegend in der Tagdrift gefangen, während andere auch in der Dämmerung oder nachts ihre Driftmaxima hatten (Schmidt & Müller 1967, Schmidt 1969, Martin 2006).

Phänologie

Die vier häufigsten *Unionicola*-Arten der Untersuchung kamen im Jahresverlauf in sehr unterschiedlichen Abundanzen in der Drift vor. Vom September bis November 1977, der Hauptregenzeit mit den höchsten Abflussmengen, waren sie nicht bzw. fast nicht in den Driftfängen vertreten. Die höchsten Abundanzen lagen meist am Beginn der Regenzeit (Abb. 3).

Unionicola cooki war die häufigste der vier Arten. Sie erschien als Adultus in ersten wenigen Exemplaren bereits bei abnehmenden Fließgeschwindigkeiten im Januar bis März. Mit Beginn des Abflusses nach der Trockenzeit

ab Mai war sie dann regelmäßig in der Drift vertreten mit einem deutlichen Maximum im Juni. Bis September sank die Abundanz dann stetig bis auf Null.

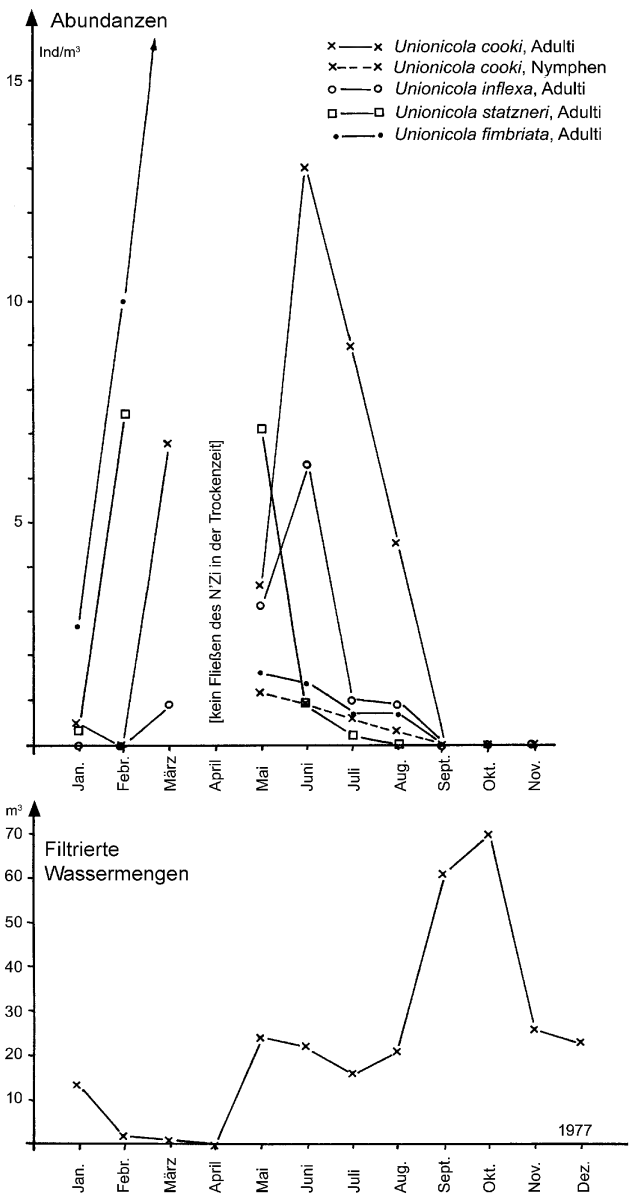

Abb. 3. Abundanzen der vier dominanten *Unionicola*-Arten in der Nachtdrift des N'Zi 1,5 Stunden nach Sonnenuntergang, von Januar bis November 1977; die Fänge an den fünf Untersuchungsstationen sind jeweils aufsummiert. Unten die filtrierten Wassermengen, die in ihrer Relation in etwa dem Abflussgang des N'Zi entsprechen. – Im April floss der N'Zi nicht und im Februar und März nur an den südlichen Stationen (vgl. Tab. 1). In diesen beiden Monaten konnten nur geringe Wassermengen filtriert werden, in denen nur wenige Milben enthalten waren, insofern ergeben die errechneten Abundanzen hier ein etwas verzerrtes Bild. Die Abundanzen der Tagdrift 2 Stunden vor Dunkelheit entsprachen in ihren Relationen im Wesentlichen denen der Nachtdrift, waren jedoch deutlich geringer.

U. cooki lebte also als Adultus offenbar vor allem in den während der Trockenzeit stehenden Flussseen und wurde dann als limnophile Art mit Einsetzen des Abflusses aus diesen ausgeschwemmt. Dieser Prozess setzte sich fort, bis dann mit Beginn der Hauptregenzeit Ende August und dem Maximum des Abflusses im September und Oktober alle Adulti abgedriftet waren. Mit Abnehmen der Fließgeschwindigkeit schlüpften dann wieder erste Adulti aus den Ruhestadien und erschienen so noch vor der Haupttrockenzeit bereits wieder in wenigen Exemplaren in der Drift.

Nymphen wurden nur von *U. cooki* in nennenswerter Zahl gefangen, da die Maschenweite der Driftnetze von 320 × 200 µm für Nymphen eigentlich zu groß war. Insgesamt wurden 216 *U. cooki*-Nymphen gefangen. Sie kamen von Mai bis August in der Drift vor, einige Tiere auch noch in der Tagdrift im September. Damit zeigten sie eine ganz ähnliche Phänologie wie die Adulti, wurden nur wegen ihrer geringeren Größe weniger in den Driftnetzen gefangen. Die Nymphen und Adulti der *Unionicola*-Arten haben die gleiche Lebensweise und reagieren damit auch in gleicher Weise auf Stagnation oder Fließen ihres Gewässers.

Die in der Trockenzeit in den stehenden Flussseen geschlüpften und dort freischwimmend lebenden Nymphen von *U. cooki* wurden also offenbar, wenn sie nicht zuvor in ihr Postlarvales Ruhestadium II eingetreten waren, mit Beginn der Regenzeit, als das Wasser wieder zu fließen begann, aus den Flussseen ausgeschwemmt. Ab August waren die Nymphen aber offenbar im Wesentlichen in ihr Ruhestadium eingetreten, sodass nur noch sehr wenige beim stärksten Abfluss im September und keine mehr im Oktober in der Drift zu finden waren. Als Adulti erschienen sie dann nach dem Schlupf aus den Ruhestadien ab Januar in Einzeltieren wieder in der Drift.

Unionicola inflexa hat als Adultus eine ganz ähnliche Phänologie wie *U. cooki*. Auch sie tauchte mit Beginn der Regenzeit in der Drift auf, hatte ihre höchste Abundanz im Juni, ging dann stark zurück, um ab September praktisch nicht mehr in der Drift vorzukommen.

Von der kleineren *U. inflexa* wurden lediglich vier Nymphen bei Tinbé in der Drift gefangen: eine am 4.V.1977 in der Tagdrift und drei am 1.VI.1977 in der Nachtdrift. Diese Nymphen-Fänge im Mai und Juni deuten darauf hin, dass ähnliche Verhältnisse wie bei *U. cooki* vorliegen dürften.

Unionicola statzneri passte sich in das allgemeine Bild ein. Direkt nach der Trockenzeit im Mai mit Wiederbeginn des Fließens des N'Zi wurde sie in den höchsten Abundanzen in der Drift gefangen, als die Tiere, die in den stehenden Flussseen lebten, plötzlich ausgeschwemmt wurden. Danach nahm die Drift stark ab, um ab August während der nachfolgenden stärksten Abflüsse auf Null zu sinken. Die ersten Adulti tauchten dann erst kurz vor

der Haupttrockenzeit des nächsten Jahres wieder in der Drift auf. Auch 80 % der 52 gefangenen Nymphen stammten aus dem Mai.

Unionicola fimbriata hat gegenüber den drei vorgenannten Arten eine etwas verschobene Phänologie. Ihre Abundanzen in der Drift stiegen bereits vor der Haupttrockenzeit, als der N'Zi gerade noch floss, stark an und sanken dann auf ein niedrigeres Niveau nach der Trockenzeit im Mai bis August ab, um in der Zeit des Hauptabflusses im September und Oktober wie bei den anderen Arten praktisch bei Null zu liegen.

Die Abundanzen zeigen, dass die untersuchten limnophilen Hydrachnidia ihren Lebensraum in den während der Trockenzeit weitgehend stehenden und voneinander getrennten Flussseen haben. Im Norden kommt der N'Zi im Februar, im Süden erst im April zum Stehen.

Nach Beginn der Regenzeit, wenn der N'Zi wieder fließt, wird er nach und nach von den schwimmenden Tieren leergeschwemmt, soweit sie sich nicht in Refugien zurückziehen oder in Stadien eintreten können, die der Drift entzogen sind. Zum Höhepunkt des Abflusses im September und Oktober erscheint diese Stillwasserfauna daher kaum mehr in der Drift.

Die erneute Entwicklung bzw. das Schlüpfen aus den Ruhestadien der limnophilen Fauna beginnt dann je nach Art unterschiedlich früh, bereits mit dem Abnehmen der Fließgeschwindigkeit (*U. fimbriata*) oder erst mit dem Stillstand der einzelnen Flussabschnitte (*U. inflexa* und auch *U. cooki*).

Entwicklungszyklus

In tropischen und subtropischen Gebieten mit ausgeprägtem Wechsel von Trocken- und Regenzeiten, die zwischen den Wendekreisen durch Zenitalregen verursacht werden, sind temporäre Fließgewässer nicht selten und daher Anpassungen im Entwicklungszyklus an diese Gegebenheiten zu erwarten.

Die freilebenden Nymphen und Adulti der Gattung *Unionicola* gehören weitgehend dem Plankton der stehenden Flußseen an, wie auch ihre Hauptbeutetiere. Daher werden sie zusammen mit dem Plankton passiv verfrachtet und mit Beginn der Regenzeit aus den Flussseen ausgeschwemmt. Da der N'Zi in der Hauptregenzeit ein durchgehend stark fließender Strom ist, haben die verdrifteten Milben des Planktons auch keine Chance auf Reproduktion weiter flussabwärts und gehen damit der Population verloren.

Eine Chance auf Reproduktion im System haben nur die Tiere, die rechtzeitig vor dem Abfluss in ihre Ruhestadien (geschützt in Mollusken bzw. Schwämmen) eintreten oder als Adulti rechtzeitig zur Eiablage gekommen sind. Aus den Ruhestadien schlüpfen können zumindest die Nymphen und Adulti erst, wenn die Flussseen weitgehend zum Stillstand gekommen sind.

Das erfordert eine Anpassung an dieses Wasserregime durch eine sonst nicht bekannte Verlängerung der Ruhestadien auf mindestens drei Monate (September bis November), in denen keine *Unionicola* in der Drift auftraten (Abb. 3, Tab. 1). Vermutlich muss diese Zeit sogar noch bedeutend länger sein, da die Abflüsse darüber hinaus, freilich regional unterschiedlich, noch so stark waren, dass sie Plankton verdrifteten.

Denkbar wäre auch eine nicht weniger ungewöhnliche Anpassung, nämlich ein Aufenthalt der Tiere in den Mollusken bereits vor dem jeweiligen Ruhestadium oder danach, um die monatelange Zeit geschützt vor Verdriftung zu überbrücken.

Dies würde jedoch bedeuten, dass Arten mit zwei so langen Ruhestadien/Ruhephasen in Mollusken einen zweijährigen Entwicklungszyklus haben müssen. Das ist in einem tropisch/subtropischen Gebiet mit seinen hohen Temperaturen eine ungewöhnlich lange Zeit für wirbellose Tiere, bei denen hohe Temperaturen die Entwicklung normalerweise stark beschleunigen. Nach Statzner (1982) lagen im Untersuchungsgebiet die Wassertemperaturen in der Strömung in der Hauptregenzeit zwischen 26 und 27 °C und schwankten in der Trockenzeit weit zwischen 28 und 35 °C.

Nach diesem Szenario könnten die Milben die für sie an sich günstigen Bedingungen in den stehenden Flussseen mit ihrer erhöhten Primärproduktion (Statzner 1982) nicht für zusätzliche Generationen und eine dadurch wesentlich erhöhte Reproduktionsrate nutzen.

An den ♀♀ war gut ablesbar, dass von der Drift Tiere aller Altersstufen erfasst werden: Tiere direkt nach dem Schlupf mit noch nicht oder kaum entwickelten Eiern, Tiere nach dem Reifefraß prall gefüllt mit Eiern und Tiere nach der Ablage zumindest eines großen Teils ihrer Eier. Wegen der großen jährlichen Schwankungen in Stärke und Verlauf im Abfluss des N'Zi (Camus 1971) sind offenbar der Eintritt in die Ruhestadien und das Schlüpfen aus ihnen nicht streng synchronisiert, sondern variieren in relativ weiten Bereichen.

Der Aderlass für die Population durch die Drift ist nicht unbeträchtlich, wie an den gefangenen Nymphen und ovigeren ♀♀ in den relativ kurzen Expositionszeiten der Driftnetze zu sehen ist. Er muss durch eine entsprechende Vermehrungsrate ausgeglichen werden.

Durch den anzunehmenden Parasitismus der Larven an Insekten, vielleicht sogar an Chironomiden wie in den bislang von *Unionicola* bekannten Fällen, wäre auch ein Gebietsverlust stromaufwärts zu kompensieren.

Ein zweijähriger Entwicklungszyklus, wenn auch unter gänzlich anderen Bedingungen, ist auch für zwei mitteleuropäische *Unionicola*-Arten nachgewiesen, für *U. (Pentatax) aculeata* und *U. (Pentatax) intermedia* (Hevers 1980).

4 Systematik

4.1 Allgemeines

Die Einteilung der Gattung *Unionicola* in Untergattungen ist im Fluss. COOK (1974) unterschied nur acht Untergattungen, zu denen bei K. O. VIETS (1987) lediglich zwei hinzugekommen waren. Die bei weitem umfangreichsten Untergattungen waren *Unionicola* s. str. und *Pentatax*, die sich in der Anzahl der Näpfe (= Acetabula) auf den Napfplatten um die Genitalöffnung unterschieden (*Unionicola* s. str. sechs Napfpaare, *Pentatax* fünf Napfpaare). Insbesondere die Zuordnung zu diesen beiden Untergattungen entspricht nicht verwandtschaftlichen Beziehungen, sondern trennt teilweise sich offensichtlich sehr nahe stehende Arten.

[Anmerkung: Die Näpfe auf den Napfplatten um die Genitalöffnung, denen systematisch eine so große Bedeutung beigemessen wird, sind nach ultrastrukturellen und histochemischen Untersuchungen von ALBERTI (1977, 1979) bei den Hydrachnidia Organe der Osmoregulation. Die Näpfe der im hypotonischen Medium lebenden Süßwassermilben können aktiv Ionen aus dem Wasser aufnehmen, anreichern und bei Bedarf in die Hämolymphe abgeben, sie sind damit für die Ionenregulation wichtige Organe. Trotz ihrer räumlichen Nähe zum Genitalapparat haben die Näpfe daher mit der Fortpflanzung direkt nichts zu tun.]

VIDRINE versuchte der unbefriedigenden Gruppierung innerhalb der Gattung *Unionicola* abzuhelfen, indem er in 10 Publikationen (zusammengefasst in VIDRINE 1996) nicht weniger als 34 neue Untergattungen benannte, vier zuvor eigenständige Gattungen zu Untergattungen von *Unionicola* herabstufte und so letztlich *Unionicola* in 50 Untergattungen einteilte, von denen 19 nur jeweils eine Art und neun weitere nur zwei Arten enthielten. Die weitaus meisten Arten (42) wurden in die Untergattung *Unionicola* s. str. gestellt, die damit Sammel-Untergattung wurde, in der alle nicht anderweitig abzutrennenden Arten verblieben.

Die Diagnosen der neuen bzw. neu gruppierten Untergattungen sind unzureichend, es werden vielfach Negativmerkmale (Merkmale, die n i c h t vorhanden sind) verwendet. Es fehlt oft eine Differentialdiagnose, die die Untergattungen eindeutig von anderen abgrenzt. Der Untergattungen-Bestimmungsschlüssel nach VIDRINE (1996) ist unpraktikabel, vielfach verweist er lediglich ohne jede Erläuterung auf Abbildungen (einer Art), die ihrerseits in ihrer Qualität unakzeptabel sind.

Inzwischen hat VIDRINE in fünf weiteren Publikationen mit wechselnden Koautoren fünf weitere Untergattungen benannt (GLEDHILL & VIDRINE 2002; VIDRINE et al. 2005, 2006, 2007a, 2007b), und SMIT (2008) beschrieb zwei neue Untergattungen von *Unionicola* und synonymisierte eine, sodass heute 56 Untergattungen publiziert sind.

Die von VIDRINE vorgeschlagene Untergattungs-Einteilung stellt meines Erachtens eine unnötige Zersplitterung dar, die in vielen Fällen nicht nachvollziehbar ist. Sie kann daher nicht die dringend erforderliche Revision des Untergattungs-Systems von *Unionicola* darstellen. Bis zu einer stimmigen Klärung dieser Probleme verwende ich deshalb im Folgenden das hergebrachte System (bis K. O. VIETS 1987), vermerke jedoch (in eckigen Klammern), welcher Untergattung eine Art im abweichenden Fall nach VIDRINE (1992, 1996) zugeordnet würde.

Im Folgenden werden die aus dem N'Zi nachgewiesenen Arten behandelt: drei aus der Untergattung *Armatax*, sieben aus der Untergattung *Pentatax* und zwei aus der Untergattung *Unionicola*.

4.2 Untergattung *Armatax* Bader, 1981

Unionicola (Armatax) cooki Bader, 1981

Unionicola (Armatax) cooki: SMIT (1994)

BADER (1981) beschrieb die Art nach 9 ♂♂ und 21 ♀♀ aus Kamerun, wobei er insbesondere die Kürze der Beugeseitenzapfen am P.4 und die Kleinheit der Tiere gegenüber *U. koenikei* hervorhob (vgl. Nachbeschreibung von *U. koenikei* in Kap. 5). SMIT (1994) beschrieb 12 ♂♂ und 11 ♀♀, ebenfalls aus Kamerun, die jedoch etwa 30 % größer waren als die von BADER. SMIT untersuchte Paratypen von BADER und stellte als abgrenzendes Merkmal zu *U. koenikei* für *U. cooki* die Lage des Beugeseitenzapfen am P.5 in der Gliedmitte fest. Aus dem NHMB lagen mir ebenfalls Paratypen vor (3 ♂♂, 4 ♀♀). Der in der Beugeseitenmitte des P.5 liegende Zapfen war stets als Doppelzapfen mit zwei deutlich getrennten Spitzen ausgebildet.

Danach kommt im N'Zi der Elfenbeinküste *U. cooki* vor. Von den 1353 Tieren wurden 18 ♂♂, 23 ♀♀ und 11 Nymphen präpariert und vermessen. Bei allen liegt der Beugeseitenzapfen des P.5 in der Gliedmitte. Er ist als Doppelzapfen mit zwei Zähnen ausgebildet (Abb. 5–9, 12–16), auch bereits bei den Nymphen (Abb. 19–20).

Die Extremitätenmaße variieren beträchtlich (Tab. 2), auch in den Proportionen zueinander. Aus relativ homogenem Material kleinerer Tiere von Kolomikro (7.VI.1977, Tagdrift) wurde für das Proportionalitätsdiagramm der Abb. 24 eine Eichkurve aus 12 ♂♂ (Null-Gruppe) (Präp. 951–962) und 10 ♀♀ (Präp. 969–978) erstellt. Zu diesen Kurven passen erstaunlich genau die Maße, die BADER (1981) für den Holotypus (♀) und als Mittelwerte für 2 ♂♂ und 10 ♀♀ angibt. Seine Tiere sind nur etwas kleiner als die aus dem N'Zi von Kolomikro, und die Maße des Holotypus sind durch keine Mittelwertbildung gedämpft.

Das Mittel von 3 ♂♂ (Präp. 966–968) und 3 ♀♀ (Präp. 988–990) aus dem N'Zi, die wesentlich größer waren, aber untereinander ähnliche Extremitätenmaße aufwiesen, ergab etwas abweichende Kurvenverläufe (Abb. 24), die aber wiederum sehr gut zu den Maßen von *U. cooki* aus SMIT (1994) passen. Durch freundliche Vermittlung

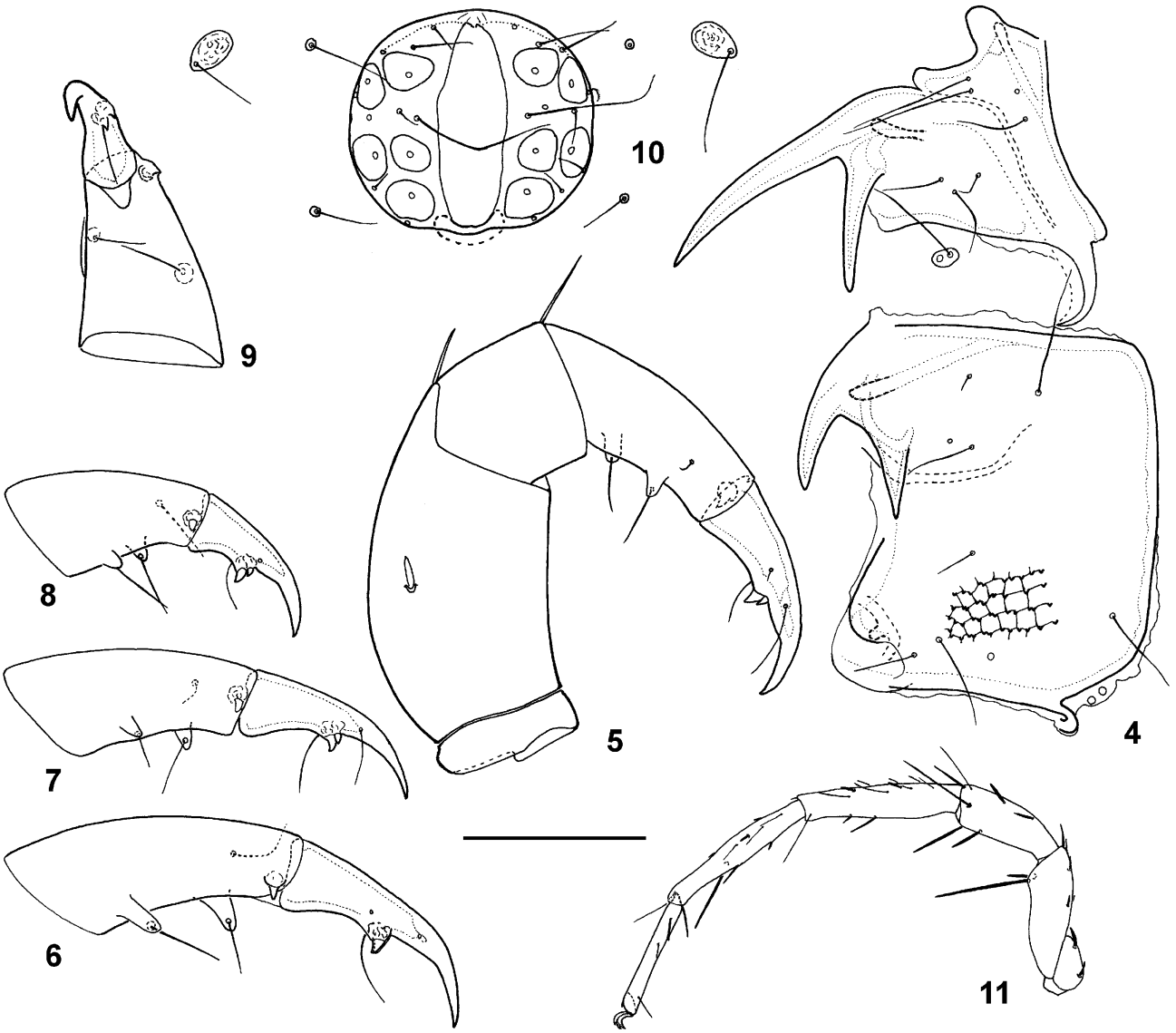

Abb. 4–11. *Unionicola cooki*, ♂♂. – **4**. Rechte 1.–4. Coxalplatten mit den kräftigen Chitinfortsätzen an den 2. und 3. Coxalplatten, Präp. 958. **5**. Linke Palpe von innen, Präp. 954. **6**. Linke P.4+5 von innen, Präp. 968. **7**. Linke P.4+5 von innen, Präp. 958. **8**. Linke P.4+5 von innen, Präp. 964. **9**. Rechte P.4+5 ventral, Präp. 954. **10**. Napfplatten, Präp. 958. **11**. 1. linkes Bein von hinten, Präp. 962. – Maßstrich: 100 µm (4–10), 200 µm (11).

von Drs. HARRY SMIT, Alkmaar, konnte ich 2 ♂♂ (Präp. CAM 2 und 3) und 3 ♀♀ (Präp. CAM 5, 6 und 9) seiner Tiere ausleihen und vermessen, die im ZMAN hinterlegt sind. *U. cooki* besitzt offensichtlich eine große Variationsbreite, wodurch eine eindeutige Charakterisierung durch eine einzige Proportionalitätskurve kaum möglich ist.

Die Idiosomagröße variiert je nach Entwicklungszustand erheblich, bei den ♀♀ insbesondere durch die Zahl der enthaltenen Eier: ♂♂: 354 × 285 µm bis 649 × 510 µm (n = 18), ♀♀: 362 × 293 µm bis 796 × 645 µm (n = 23), Nymphen: 302 × 236 µm bis 520 × 466 µm (n = 11).

U. cooki ist in dem vorliegenden Material aus den N'Zi der Elfenbeinküste die häufigste *Unionicola*-Art mit insgesamt 1353 Tieren (469 ♂♂, 667 ♀♀, 217 Nymphen). *U. cooki* kam in der Tagdrift (226 ♂♂, 278 ♀♀, 156 Nymphen) und in der Nachtdrift (243 ♂♂, 389 ♀♀, 61 Nymphen) vor. Sie wurde an allen fünf Untersuchungsstationen im N'Zi gefangen: Tinbé: 99 ♂♂, 93 ♀♀, 26 Nymphen; Fetekro: 35 ♂♂, 124 ♀♀, 10 Nymphen; Ouokoukro: 65 ♂♂, 69 ♀♀, 63 Nymphen; Kolomikro: 211 ♂♂, 266 ♀♀, 36 Nymphen; Bocanda: 59 ♂♂, 115 ♀♀, 82 Nymphen. Zur Phänologie siehe Kap. 3.

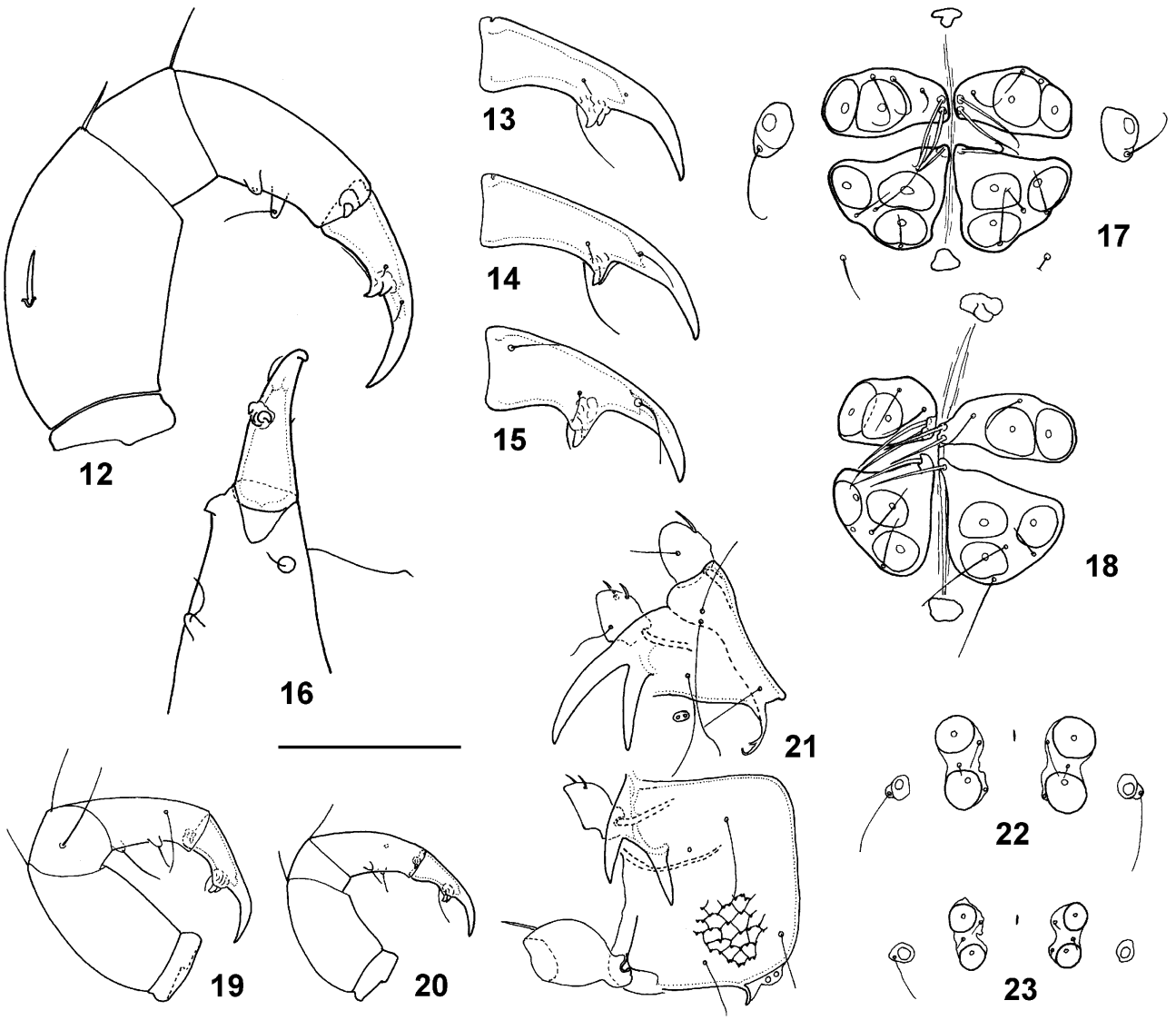

Abb. 12–23. *Unionicola cooki*, ♀♀ (12–18), Nymphen (19–23). – **12**. Rechte Palpe von außen, Präp. 974. **13**. Rechte P.4+5 von außen, Präp. 989. **14**. Rechte P.4+5 von außen, Präp. 990. **15**. Rechte P.4+5 von außen, Präp. 991. **16**. Linke P.4+5 ventral, Präp. 977. **17**. Napfplatten, Präp. 988. **18**. Napfplatten, Präp. 978. **19**. Rechte Palpe von außen, Präp. 1001. **20**. Linke Palpe von innen, Präp. 994. **21**. Rechte 1.–4. Coxalplatten mit den kräftigen Chitinfortsätzen an den 2. und 3. Coxalplatten, Präp. 997. **22**. Napfplatten, Präp. 993. **23**. Napfplatten, Präp. 994. – Maßstrich: 100 µm.

Unionicola (Armatax) dentifera Cook, 1966

Cook (1966) beschrieb die Art nach 2 ♂♂ und 2 ♀♀ aus Liberia, die er am 30.VII.1958 in einem „water filled ditch (actally the backwater area of a stream)" „in the Congo Town area" nahe der Ozeanküste fing. Sie wurde seither nicht wieder gefunden.

U. dentifera ist *U. koenikei* und *U. cooki* sehr ähnlich, die Napfplatten tragen jedoch 12 und nicht 10 Näpfe. Der Beugeseitenzapfen des P.5 ist ein Doppelzapfen mit zwei Spitzen und liegt in der Gliedmitte wie bei *U. cooki*. Die Beugeseiten-Zapfen des P.4 sind, wie Abb. 467 in Cook (1966) zeigt, kurz wie bei *U. cooki* und nicht lang wie bei *U. koenikei*. Nach den Maßangaben von Cook (1966) und seiner Zeichnung ist das P.5 relativ zum P.4 kurz.

Unter den Syntypen von *U. koenikei* Viets, 1913 im SMF befindet sich ein ♀ mit 12 Näpfen (Präp. 1362: Kamerun, Manoka b. Duala, 31.XII.1911, Tümpel, Damköhler leg.). Die Palpen sind leider nicht abpräpariert und daher nicht zu vermessen und genau zu untersuchen. Die Napfplatten zeigen keine Anzeichen einer Missbildung (Abb. 29). Daher muss dieses ♀ nachträglich zu *U. dentifera* gestellt

Tab. 2. *Unionicola cooki*, Maße der Extremitätenglieder in µm. – Abkürzungen siehe Kap. 2.

Unionicola cooki	P		I.B.				II.B.				III.B.				IV.B.				III.+ IV.Cp.		Np.
	4	5	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	L	B	L
N'Zi, 12 kleine ♂♂, Mittelwerte, Präp. 951–962	131	108	126	176	177	137	173	241	258	230	149	202	244	211	184	241	312	289	195	156	118
N'Zi, 10 kleine ♀♀, Mittelwerte, Präp. 969–978	147	120	142	201	199	150	191	266	284	248	163	223	268	234	205	269	350	325	208	165	
N'Zi, 3 große ♂♂, Mittelwerte, Präp. 966–968	158	127	158	219	225	179	233	302	313	261	194	250	296	252	220	296	368	333	226	170	130
N'Zi, 3 große ♀♀, Mittelwerte, Präp. 988–990	176	142	170	248	256	197	246	341	353	291	208	282	333	280	235	331	414	375	227	178	
N'Zi, 11 Nymphen, Mittelwerte, Präp. 992–1002	80	68	72	98	103	91	101	137	151	139	88	115	144	132	99	139	177	173	105	83	
Bader (1981), Holotypus (♀), Kamerun	139	114	136	201	207	148	192	260	275	244	164	207	263	229	201	260	324	309			
Bader (1981), 2 ♂♂, Mittelwerte, Kamerun	121	96	121	168	169	131	158	226	237	214	133	193	228	189	168	225	287	266			
Bader (1981), 10 ♀♀, Mittelwerte, Kamerun	139	114	135	191	189	142	180	254	269	239	154	211	254	219	195	254	326	302			
Smit (1994), 2 ♂♂, Mittelwerte, Kamerun	147	121	152	212	221	173	216	298	329	281	188	245	301	266	215	299	378	349	215	168	
Smit (1994), 3 ♀♀, Mittelwerte, Kamerun	173	138	175	251	259	200	240	334	362	306	212	280	341	290	239	330	425	394	232	189	

werden. Auch Walter (1935: 104) erwähnt bei einem seiner beiden *U. koenikei*-♀♀ aus Französisch Westafrika (heute Burkina Faso) 12 Näpfe (siehe dazu auch Kap. 5).

Im Material aus dem N'Zi ist *U. dentifera* nur mit 2 ♀♀ vertreten. Fangdaten: ♀ mit 11 Eiern, 10.V.1977, bei Kolomikro, Nachtdrift (Präp. 1110); ♀ mit 80 Eiern, 12.IX.1977, bei Tinbé, Tagdrift (Präp. 1109).

Beim ♀ des Präp. 1109 waren leider die Palpen abgerissen und beim ♀ des Präp. 1110 ist die vordere linke Napfplatte missgebildet und trägt nur einen Napf (Abb. 27). Bei letzterer trägt das relativ zum P.4 kurze P.5 einen Zapfen mit Doppelzahn in Gliedmitte und die Zapfen am P.4 sind kurz (Abb. 25). Die Maße der Extremitätenglieder sind in Tab. 13 mit angegeben. In den Proportionen zeigen die Extremitätenglieder, abgesehen von dem relativ kurzen P.5, keine signifikanten Abweichungen von *U. cooki*. Die Idiosomagrößen betragen 930 × 750 µm bzw. 980 × 824 µm.

Ob die Proportionsunterschiede zwischen den beiden Palpenendgliedern und die von zwei auf drei Näpfe erhöhte Napfzahl auf den vorderen Napfplatten tatsächlich ausreichen, um *U. dentifera* neben *U. cooki* als eigenständige Art anzusehen, können endgültig erst Untersuchungen an einem größeren Material ergeben.

Unionicola (Armatax) bicornis **n. sp.**

Holotypus: ♂, Westafrika, Elfenbeinküste, Fluss N'Zi, bei Ouokoukro, 11.V.1977, Tagdrift, leg. Bernhard Statzner, Präparat 1072, SMF.

Paratypen: 19 ♂♂, 18 ♀♀, 5 Nymphen, alle Westafrika, Elfenbeinküste, Fluss N'Zi, März 1977 bis Januar 1978, Driftfänge, leg. Bernhard Statzner, Präparate 1066–1071, 1073–1108, SMF.

Derivatio nominis

Nach den beiden charakteristischen Chitinzapfen, die auf der Dorsalseite inseriert sind.

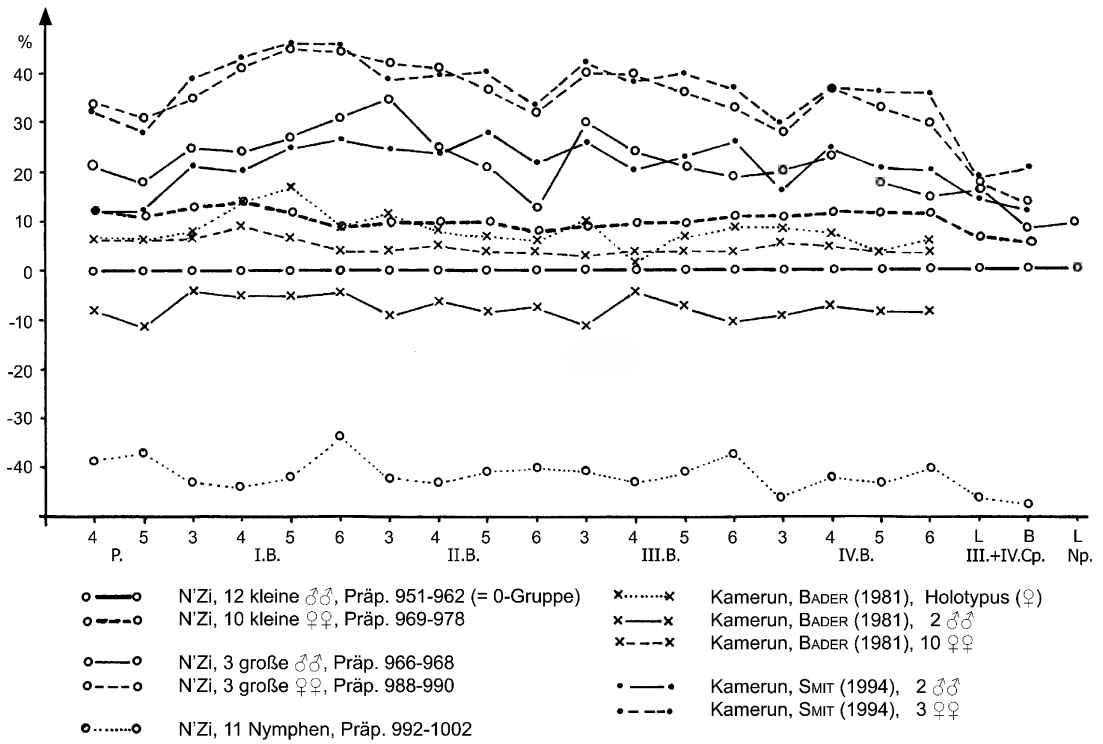

Abb. 24. Proportionalitätsdiagramm von *Unionicola cooki*. Vergleich von Tieren aus dem N'Zi mit publizierten Daten von Tieren aus Kamerun.

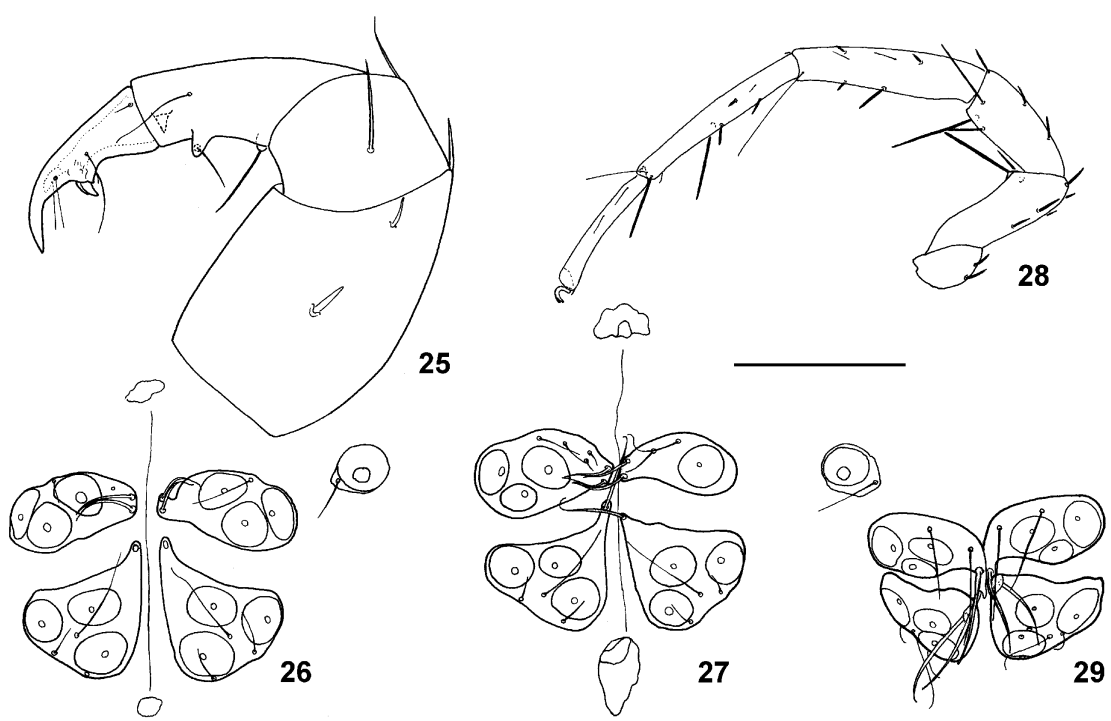

Abb. 25–29. *Unionicola dentifera*. – **25**. ♀, linke Palpe von außen, Präp. 1110. **26**. ♀, Napfplatten, Präp. 1109. **27**. ♀, Napfplatten (eine vordere missgebildet mit nur einem Napf), Präp. 1110. **28**. ♀, linkes 1. Bein von hinten, Präp. 1109. **29**. Napfplatten des von K. Viets (1913/14) zu *U. koenikei* gestellten ♀ aus Kamerun (K. Viets-Präp. 1362), das jedoch zu *U. dentifera* gehört. – Maßstrich: 100 µm (25–27, 29), 200 µm (28).

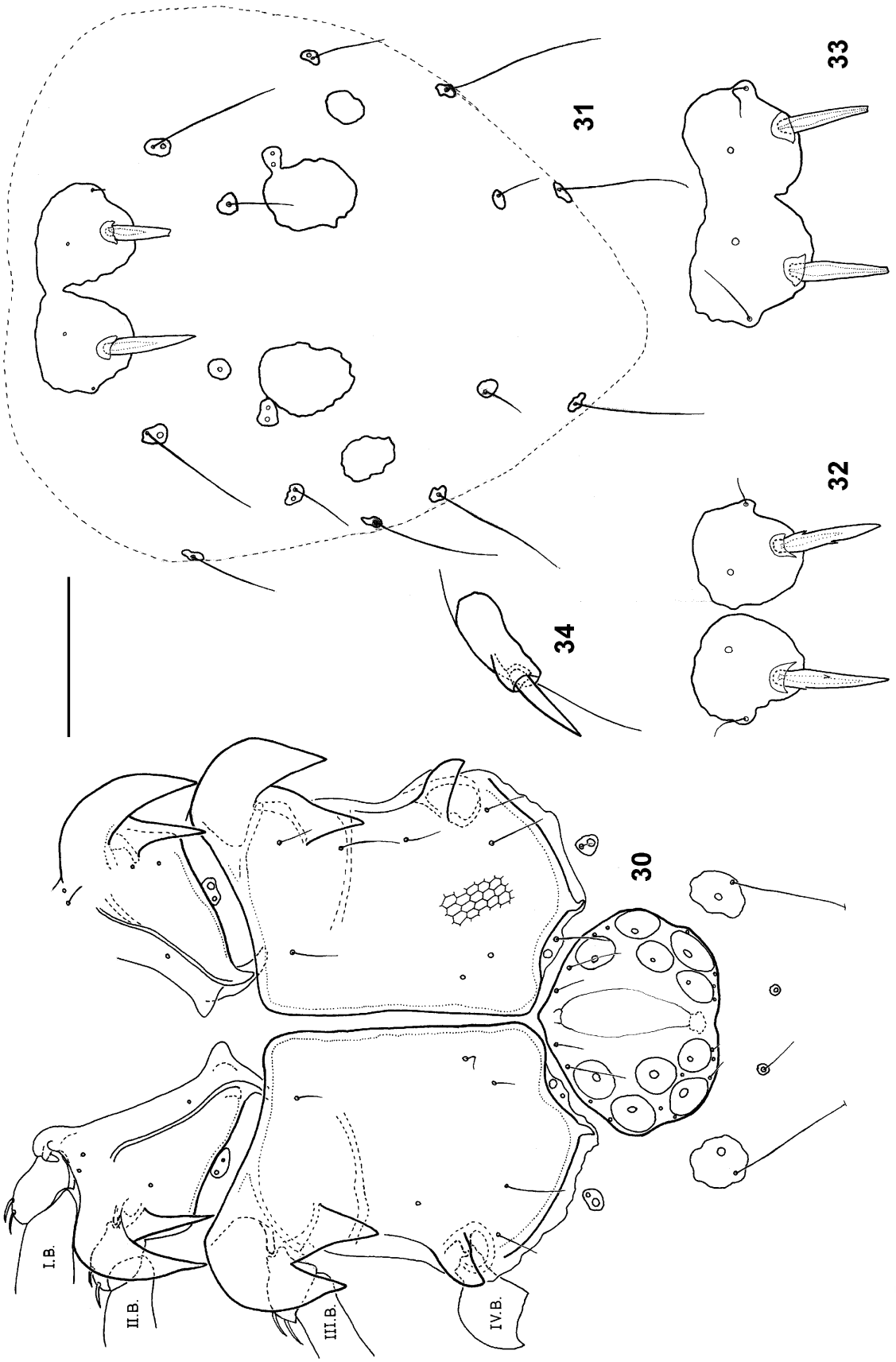

Abb. 30–34. *Unionicola bicornis* n. sp. – **30**. Holotypus, ♂, Ventralseite mit Coxalplatten und Napfplatten, Präp. 1072. **31**. ♂, Dorsalseite mit Chitinplatten, Borsten und den beiden charakteristischen Zapfen, Präp. 1082. **32**. ♀, die beiden charakteristischen Zapfen der Dorsalseite hier mit Seitenzähnchen und auf getrennten Chitinplatten, Präp. 1102. **33**. ♀, die beiden Zapfen auf zusammengewachsenen Chitinplatten, Präp. 1087. **34**. ♂, einer der charakteristischen Zapfen von der Seite, Präp. 1084. – Maßstrich: 100 µm.

Diagnose

Die Art der Untergattung *Armatax* Bader, 1981 trägt zwei kräftige, beweglich eingelenkte Chitinzapfen auf den vorderen Chitinplatten der Dorsalseite des Idiosoma; Maße in Tab. 3, Zeichnungen siehe Abb. 30–64.

Die dorsalen Chitinzapfen sind für *Unionicola* bislang einzigartig (Abb. 31–33). Die Zapfen können lichtoptisch sichtbare Seitenzähnchen besitzen (Abb. 32). Die Umrisse der Chitinplatten sind unregelmäßig und variieren, sodass die vorderen beiden meist in einem kurzen medianen Bereich verschmolzen sind, aber auch vollständig getrennt oder in ganzer Breite zu einer Platte vereinigt sein können.

Die Extremitäten sind bedeutend kürzer als bei *U. cooki*, und im Gegensatz zu *U. cooki* sind die II.B. kürzer als die III.B. (Tab. 3, Abb. 42–43). Auffallend ist die kräftige gezähnte Borste am distalen Ende des I.B.5. Länge, Form und Zahnbesatz variieren stark (Abb. 40).

Beschreibung/Variabilität

Die II. und III.Cp. haben lateral kräftige doppelte Hakenfortsätze und die IV.Cp. einen kleineren einfachen Fortsatz (Abb. 30). *U. bicornis* gehört daher in die Untergattung *Armatax*.

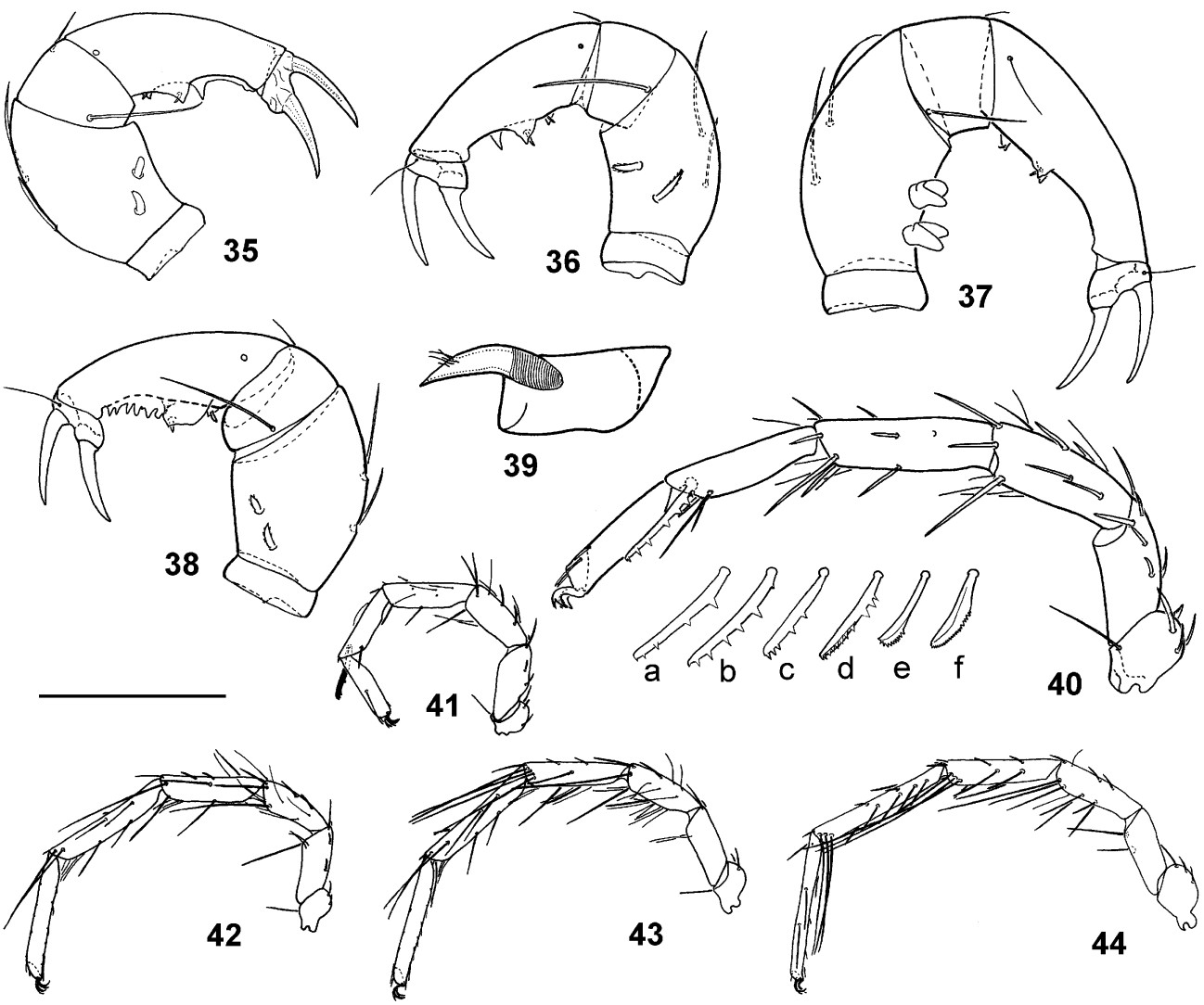

Abb. 35–44. *Unionicola bicornis* n. sp. – **35**. Holotypus, ♂, rechte Palpe von außen, Präp. 1072. **36**. ♂, linke Palpe von außen, Präp. 1083. **37**. ♀, rechte Palpe von außen, Präp. 1088. **38**. ♂, linke Palpe von außen, Präp. 1075. **39**. ♂, Chelicere, Präp. 1076. **40**. ♂, rechtes 1. Bein von vorne, Präp. 1081 [Insets: charakteristische Borste am I.B.5 vorne. **a**. ♀, Präp. 1101. **b**. ♀, Präp. 1097. **c**. Holotypus, ♂, Präp. 1072. **d**. ♂, Präp. 1077. **e**. ♂, Präp. 1079. **f**. ♂, Präp. 1085]. **41**. Holotypus, ♂, linkes 1. Bein von hinten, Präp. 1072. **42**. Holotypus, ♂, linkes 2. Bein von hinten, Präp. 1072. **43**. Holotypus, ♂, linkes 3. Bein von hinten, Präp. 1072. **44**. Holotypus, ♂, linkes 4. Bein von hinten, Präp. 1072. – Maßstrich: 100 µm (35–40), 200 µm (41–44).

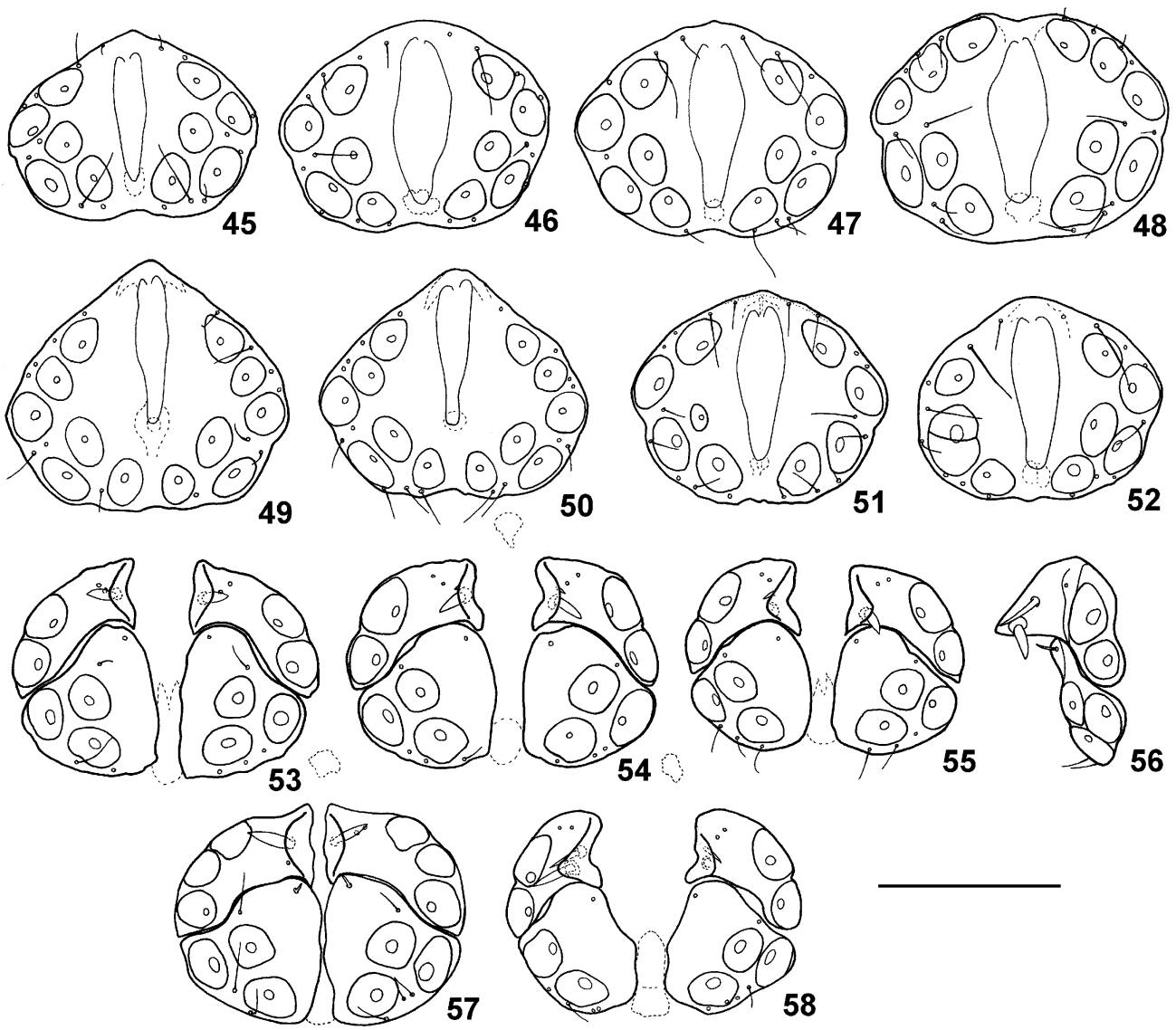

Abb. 45–58. *Unionicola bicornis* n. sp., Napfplatten. – **45**. ♂, 10 Näpfe, Präp. 1082. **46**. ♂, 10 Näpfe, Präp. 1084. **47**. ♂, 10 Näpfe, Präp. 1068. **48**. ♂, 12 statt 10 Näpfe, Präp. 1085. **49**. ♂, 12 statt 10 Näpfe, Präp. 1077. **50**. ♂, 12 statt 10 Näpfe, Präp. 1078. **51**. ♂, weniger als 10 Näpfe, Präp. 1069. **52**. ♂, weniger als 10 Näpfe, Präp. 1074. **53**. ♀, 10 Näpfe, Präp. 1088. **54**. ♀, 10 Näpfe, Präp. 1086. **55**. ♀, 10 Näpfe, Präp. 1102. **56**. ♀, Napfplatten von der Seite, Präp. 1103. **57**. ♀, mehr als 10 Näpfe, Präp. 1095. **58**. ♀, weniger als 10 Näpfe, Präp. 1099. – Maßstrich: 100 µm.

Wie bei *Unionicola* üblich haben die ♀♀ vier Napfplatten um die Geschlechtsöffnung und die ♂♂ zwei Napfplatten, die vorne und hinten verwachsen sind. Diese verwachsenen Napfplatten können bei den ♂♂ vorne zugespitzt (Abb. 45) oder gerundet sein (Abb. 46). Die Napfplatten tragen in der Regel 10 Näpfe. Es kommen aber auch Abweichungen mit 8, 9, 11 und 12 Näpfen vor (Abb. 48–52, 57–58). Von den 38 gefangenen Adulti haben allein 7 abweichende Napfzahlen.

Auch die Palpen variieren stark. Das P.4 hat normalerweise auf der Beugeseite drei Zapfen, von denen die beiden proximalen jeweils eine kleine Borste tragen (Abb. 35–37). Der laterale spitze Zapfen kann jedoch auch vervielfacht werden, sodass der Eindruck eines vielzinkigen Kammes

Tab. 3. *Unionicola bicornis* n. sp., Maße der Extremitätenglieder in µm. – Abkürzungen siehe Kap. 2.

Unionicola bicornis n. sp.	P		I.B.				II.B.				III.B.				IV.B.				III.+ IV.Cp.		Np.
	4	5	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	L	B	L
Holotypus, ♂, Ouokoukro, 11.V.1977, Präp. 1072	115	57	85	92	85	82	83	109	140	137	89	113	143	140	98	123	159	154	–	–	110
N'Zi, 20 ♂♂, Mittelwerte, Präp. 1066–1085	127	60	87	97	88	86	87	111	144	142	93	115	150	148	101	128	166	166	207	151	118
N'Zi, 20 ♂♂, Maxima, Präp. 1066–1085	144	66	95	106	95	100	100	120	160	158	102	132	171	165	118	148	185	180	240	164	133
N'Zi, 20 ♂♂, Minima, Präp. 1066–1085	115	52	81	88	80	75	74	97	127	129	81	94	127	127	83	107	140	142	186	132	106
N'Zi, 18 ♀♀, Mittelwerte, Präp. 1086–1103	139	67	96	107	96	87	91	120	156	149	98	125	164	155	114	144	186	177	227	170	
N'Zi, 18 ♀♀, Maxima, Präp. 1086–1103	158	72	103	120	103	95	100	133	168	161	110	140	178	168	123	164	201	194	247	184	
N'Zi, 18 ♀♀, Minima, Präp. 1086–1103	125	62	89	96	90	78	83	108	138	132	87	109	149	142	100	126	159	145	206	151	
N'Zi, 5 Nymphen, Mittelwerte, Präp. 1104–1108	87	45	57	64	64	67	56	71	97	105	57	74	101	105	66	86	111	113	125	89	
N'Zi, 5 Nymphen, Maxima, Präp. 1104–1108	95	51	61	70	69	73	62	79	107	115	62	80	108	115	74	95	118	126	140	96	
N'Zi, 5 Nymphen, Minima, Präp. 1104–1108	77	40	53	57	58	60	47	63	86	93	49	65	90	90	57	75	98	92	120	77	

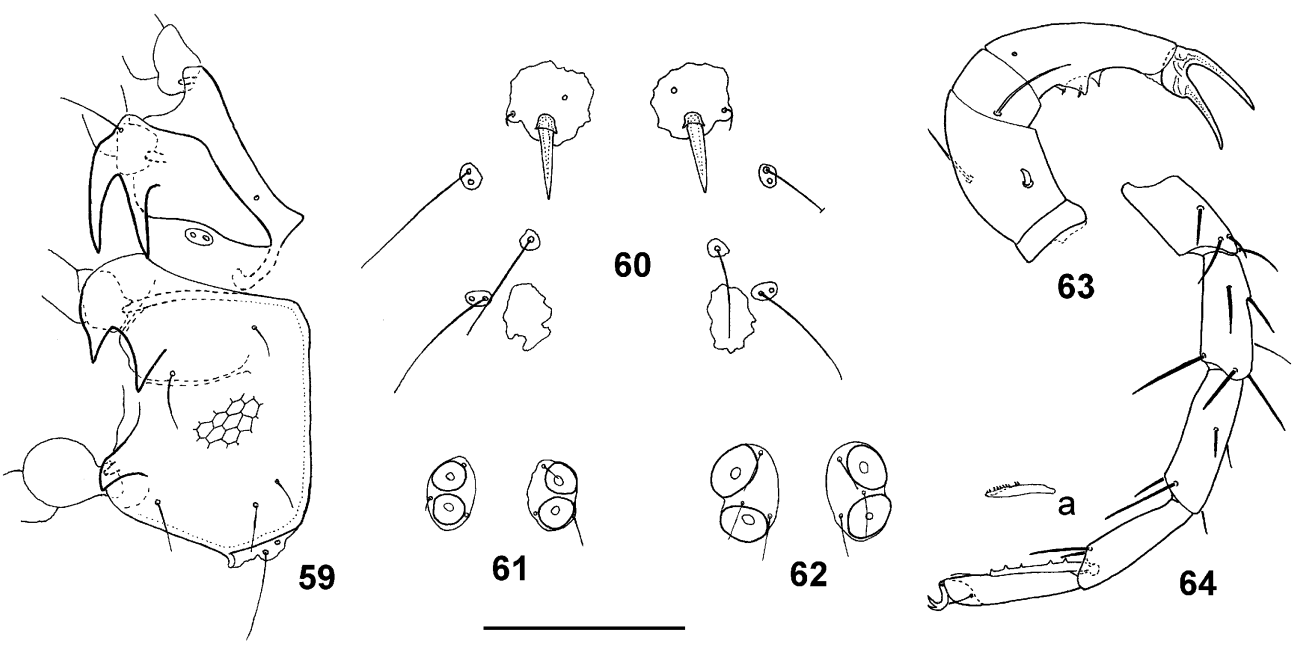

Abb. 59–64. *Unionicola bicornis* n. sp., Nymphen. – **59**. Linke 1.–4. Coxalplatten der Ventralseite, Präp. 1108. **60**. Dorsalseite mit Chitinplatten, Borsten und den beiden charakteristischen Zapfen, Präp. 1108. **61**. Napfplatten, Präp. 1104. **62**. Napfplatten, Präp. 1107. **63**. Rechte Palpe von außen, Präp. 1108. **64**. Linkes 1. Bein von vorne, Präp. 1108 [Inset: charakteristische Borste am I.B.5 vorne. **a**. Präp. 1107]. – Maßstrich: 100 µm.

entsteht (Abb. 38). 3 ♂♂ hatten ein so umgestaltetes P.4. Auf dem P.2 können die auf der Außenseite inserierenden kleineren gefiederten Borsten zu außerordentlich kräftigen, an der Spitze gespaltenen Zapfen umgewandelt sein (Abb. 37). Bei 6 ♂♂ und 5 ♀♀ war dies der Fall.

Die Nymphen besitzen ebenfalls bereits die beiden beweglich eingelenkten kräftigen Zapfen auf der Dorsalseite des Idiosoma (Abb. 60), die Hakenfortsätze an den II.–IV. Cp. (Abb. 59) und die gezähnte kräftige Borste am Distalende des I.B.5, die auch hier in Länge und Zahnbesatz stark variiert (Abb. 64). Die Napfplatten tragen insgesamt vier Näpfe, wie bei *Unionicola* üblich (Abb. 61–62).

Idiosomagrößen: ♂♂: 378 × 313 µm bis 600 × 258 µm (n = 20), ♀♀: 460 × 347 µm bis 630 × 414 µm (n = 18), Nymphen: 345 × 282 µm bis 445 × 330 µm (n = 5).

Phänologie/Verbreitung

U. bicornis wurde in 59 Individuen (23 ♂♂, 29 ♀♀, 7 Nymphen) gefangen. Sie kam im März, Mai und Juni 1977 und in jeweils einem Tier im Juli 1977 und Januar 1978 in der Drift vor. Die Nymphen wurden im Mai 1977 gefangen. *U. bicornis* war in der Tagdrift (13 ♂♂, 15 ♀♀, 5 Nymphen) und in der Nachtdrift (10 ♂♂, 14 ♀♀, 2 Nymphen) vertreten. Sie wurde an allen fünf Untersuchungsstationen im N'Zi in geringer Zahl gefangen: Tinbé: 4 ♂♂, 3 ♀♀; Fetekro: 4 ♀♀; Ouokoukro: 12 ♂♂, 16 ♀♀, 7 Nymphen; Kolomikro: 2 ♂♂, 4 ♀♀; Bocanda: 5 ♂♂, 2 ♀♀.

4.3 Untergattung *Pentatax* Thor, 1922

Unionicola (Pentatax) falcifera (Daday, 1907)
[Vidrine (1996): Untergattung *Heversatax*]

Unionicola cunningtoni Soar, 1910
Unionicola falcifera: Lundblad (1949)

Die Art wurde von Daday (1907) nach 1 ♂ aus dem Victoriasee in Ostafrika beschrieben. Soar (1910) beschrieb unter anderem Namen ein ♀ aus dem Njassasee. Lundblad (1949) bearbeitete eine nicht genannte Anzahl ♀♀ ebenfalls aus Ostafrika aus drei Proben und lieferte die einzig brauchbaren Abbildungen.

U. falcifera ist damit eine sehr selten gefundene Art, von der auch im vorliegenden Material nur 2 ♀♀ vertreten sind. Sie wurden im N'Zi bei Ouokoukro gefangen (1 ♀ mit Eiern, 11.V.1977 Nachtdrift, Präp. 949; 1 ♀ ohne Eier, 8.VI.1977 Tagdrift, Präp. 950).

Charakteristisch ist das kurze, kräftige P.5 mit seinen mächtigen Zähnen (Abb. 67). Die vorderen Napfplatten des ♀ tragen jeweils zwei kräftige Stechborsten, während die hinteren Napfplatten nicht die bei *Unionicola* sonst übliche eine Stechborste besitzen, wie schon Lundblad (1949) feststellte (Abb. 66). Das 1. Beinpaar trägt einige Borsten mehr als Lundblad eingezeichnet hat, insbesondere vorne am I.B.5 und am I.B.6 (Abb. 68). Die Extremitätenmaße gibt Tab. 4. Die Idiosomagrößen betragen 787 × 635 µm bzw. 640 × 440 µm.

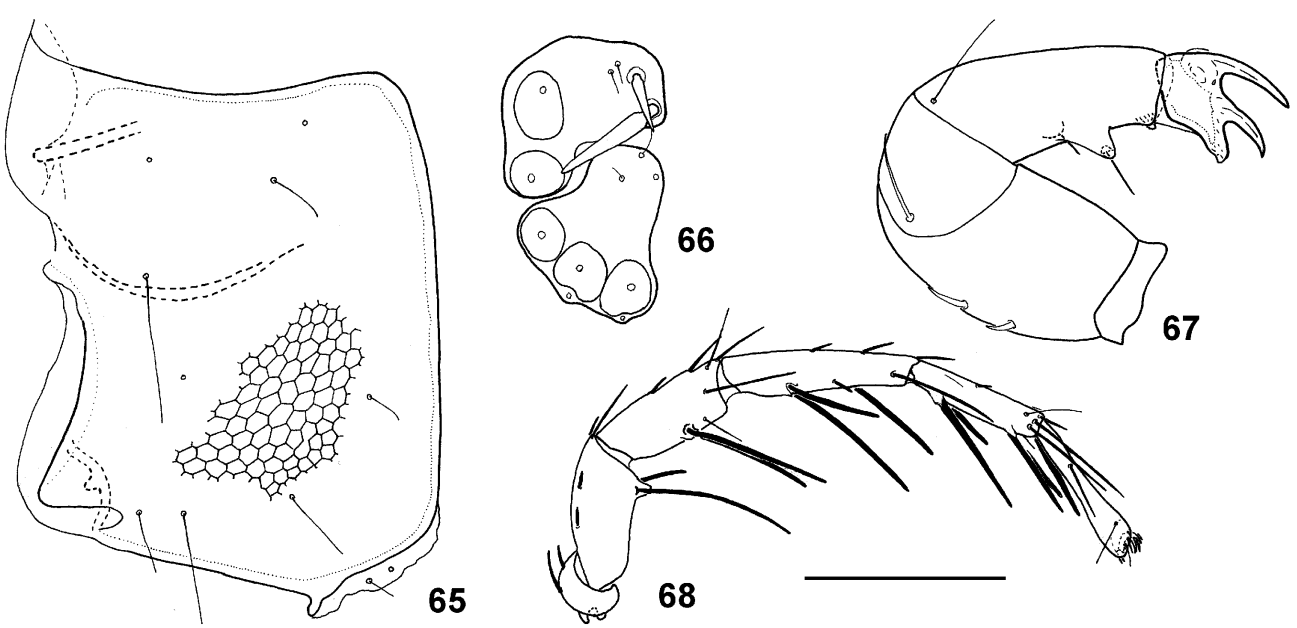

Abb. 65–68. *Unionicola falcifera*. – **65**. ♀, III.+IV.Cp., Präp. 949. **66**. ♀, rechte Napfplatten, Präp. 950. **67**. ♀, rechte Palpe von außen, Präp. 949. **68**. ♀, rechtes 1. Bein von hinten, Präp. 949. – Maßstrich: 100 µm (65–67), 200 µm (68).

Tab. 4. *Unionicola falcifera*, Maße der Extremitätenglieder in µm. – Abkürzungen siehe Kap. 2.

Unionicola falcifera	P		I.B.				II.B.				III.B.				IV.B.				III.+ IV.Cp.	
	4	5	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	L	B
N'Zi, ♀, Ouokoukro, 11.V.1977, Präp. 949	125	65	150	194	147	156	149	185	198	210	134	158	190	190	174	191	214	212	260	205
N'Zi, ♀, Ouokoukro, 8.VI.1977, Präp. 950	130	70	142	192	149	160	145	180	197	208	130	157	185	–	165	187	213	208	254	205

Unionicola (Pentatax) fimbriata Viets, 1913
[Vidrine (1996): Untergattung *Unionicola*]

Unionicola fimbriata: Viets (1916)
Unionicola fimbriata: Walter (1935)

K. Viets (1913/14) beschrieb ♂ und ♀ aus Kamerun und bildete Napfplatten und Palpe des ♂ ab; es sind bis jetzt die einzigen Abbildungen der Art. 1916 nennt K. Viets die Art von drei Fundorten ebenfalls in Kamerun. Walter (1935) meldet 1 ♂ aus Französisch Westafrika (heute Burkina Faso, vormals Obervolta).

Die Typusserie befindet sich in der Sammlung K. Viets im SMF und wurde mir freundlicherweise 1999 zur Untersuchung ausgeliehen. Sie besteht aus 4 ♂♂ und 4 ♀♀ in 7 Präparaten, die alle in „Kamerun, Manoka b. Duala" an drei verschiedenen Tagen gefangen wurden. K. Viets legte

Tab. 5. *Unionicola fimbriata*, Maße der Extremitätenglieder in µm. – Abkürzungen siehe Kap. 2.

Unionicola fimbriata	P		I.B.				II.B.				III.B.				IV.B.				III.+ IV.Cp.		Np.
	4	5	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	L	B	L
Lectotypus, ♂, K. Viets-Präp. 1276, Kamerun	57	50	125	152	104	125	140	174	201	170	121	135	148	142	124	164	223	199	159	122	90
Paralectotypen, 2 ♂♂, Mittelwerte, K. Viets-Präp. 1275, 1344, Kamerun	57	49	127	155	103	127	143	180	208	–	118	132	–	–	128	168	230	210	167	128	–
Paralectotypen, 3 ♀♀, Mittelwerte, K. Viets-Präp. 1346, 1347, 1361, Kamerun	67	56	145	177	116	130	155	206	227	184	127	152	170	157	141	183	250	235	177	137	
N'Zi, 16 ♂♂, Mittelwerte, Präp. 1003–1013, 1021–1023, 1056–1057	74	60	139	187	136	144	166	204	213	195	130	152	173	161	146	177	235	212	180	130	119
N'Zi, 16 ♂♂, Maxima, Präp. 1003–1013, 1021–1023, 1056–1057	84	66	157	212	153	161	188	226	235	217	147	167	195	178	165	194	258	238	200	141	127
N'Zi, 16 ♂♂, Minima, Präp. 1003–1013, 1021–1023, 1056–1057	59	49	95	118	97	105	112	139	149	138	92	110	125	123	110	129	176	151	148	112	87
N'Zi, 13 ♀♀, Mittelwerte, Präp. 1014–1020, 1024–1029	84	68	169	225	161	165	186	226	238	215	151	174	197	181	172	205	268	249	190	144	
N'Zi, 13 ♀♀, Maxima, Präp. 1014–1020, 1024–1029	92	75	192	244	181	185	207	245	254	236	166	192	217	200	190	220	285	267	206	155	
N'Zi, 13 ♀♀, Minima, Präp. 1014–1020, 1024–1029	70	61	145	195	125	128	152	202	217	189	133	154	170	153	146	186	232	218	168	135	

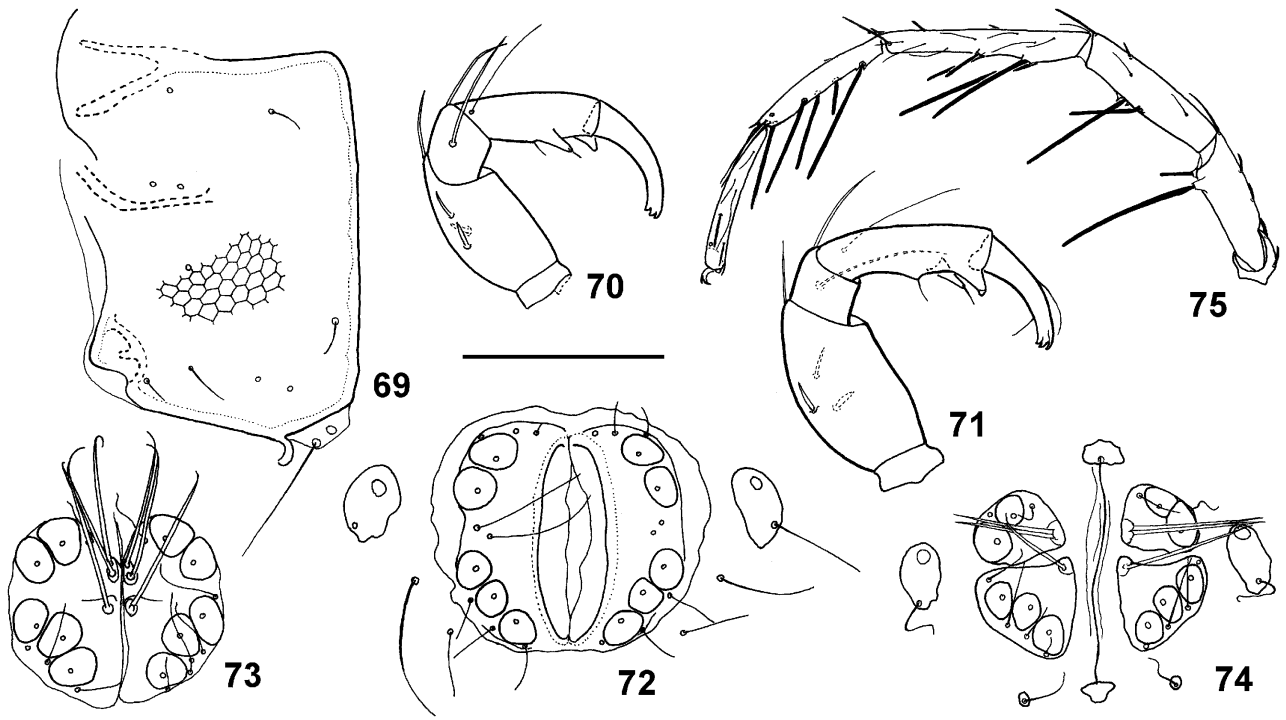

Abb. 69–75. *Unionicola fimbriata*. – **69**. ♂, III.+IV.Cp., Präp. 1008. **70**. ♂, rechte Palpe von außen, Präp. 1003. **71**. ♀, linke Palpe von innen, Präp. 1014. **72**. ♂, Napfplatten mit Chitinsaum, Präp. 1004. **73**. ♀, Napfplatten, Präp. 1017. **74**. ♀, Napfplatten, Präp. 1026. **75**. ♂, linkes 1. Bein von hinten, Präp. 1010. – Maßstrich: 100 µm (69–74), 200 µm (75).

keinen Holotypus fest, sondern bezeichnete alle Präparate als „Type" und ein ♀ als „Co-Type".

In K. VIETS (1913/14) erfolgte die Beschreibung des ♂ vor dem ♀ und ausführlicher als die des ♀. Die Abbildungen wurden offenbar nach dem ♂ in Präp. 1276 angefertigt, auch wenn die Borsten z. T. etwas idealisierend in ihrer Ausrichtung verschoben wurden.

Der Empfehlung 74B der Internationalen Regeln für die Zoologische Nomenklatur (KRAUS 2000) folgend, nach der ein abgebildetes Stück bevorzugt werden soll, wird das Tier in Präp. 1276 der Sammlung K. VIETS als Lectotypus von *Unionicola fimbriata* festgelegt. Der Lectopypus trägt die Funddaten: „Kamerun, Manoka b. Duala, 11.XI.1911, DAMKÖHLER leg." Die übrigen Syntypen werden damit zu Paralectotypen.

Lectotypus und Paralectotypen wurden – soweit möglich – neu vermessen. Die Maße des Lectotypus und weitere Maße sind in Tab. 5 wiedergegeben. Es sind relativ kleine Tiere, deren Maße teilweise sogar etwas unterhalb der Variationsbreite der Tiere aus dem N'Zi liegen.

Die Abb. 69–75 wurden nach Tieren aus dem N'Zi angefertigt; die Abb. 70–71 zeigen insbesondere die kräftige Borste auf der Außenseite des P.3 und den distalen Zapfen des P.4 ganz an dessen vorderem Rand. Die Napfplatten sind an ihrem Außenrand teilweise nur schwach chitinisiert und gehen oft kaum abgegrenzt in den vor allem bei älteren Tieren die Napfplatten umgebenden Chitinsaum über, der eine erhebliche Breite erreichen kann (Abb. 72). Die schwache Chitinisierung der Napfplattenaußenränder lässt teilweise die Abgrenzung der vier Platten bei jüngeren ♀♀ kaum erkennen.

Idiosomagrößen: ♂♂: 365 × 302 µm bis 485 × 377 µm (n = 18), ♀♀: 427 × 320 µm bis 687 × 570 µm (n = 14).

U. fimbriata könnte am ehesten mit *U. (Pentatax) uncata* Viets, 1916 verwechselt werden. Sie hat jedoch auf der Außenseite des P.3 eine unübersehbare, kräftige Borste, die sowohl K. VIETS (1916, 1925) als auch LUNDBLAD (1949) bei *U. uncata* nicht eingezeichnet haben. Außerdem sitzt der distale Zapfen des P.4 bei *U. fimbriata* am distalen Rand des Gliedes, bei *U. uncata* dagegen etwas nach proximal von ihm entfernt.

In den Driftfängen aus dem N'Zi ist *U. fimbriata* die dritthäufigste *Unionicola*-Art mit 95 ♂♂ und 394 ♀♀. Sie war in der Tagdrift (59 ♂♂, 244 ♀♀) und in der Nachtdrift (36 ♂♂, 150 ♀♀) vertreten. Auffällig ist das starke Überwiegen der ♀♀. Die Art wurde an allen fünf Untersuchungsstationen im N'Zi gefangen: Tinbé: 24 ♂♂, 65 ♀♀; Fetekro: 21 ♂♂, 54 ♀♀; Ouokoukro: 8 ♂♂, 30 ♀♀; Kolomikro: 24 ♂♂, 152 ♀♀; Bocanda: 18 ♂♂, 93 ♀♀. Zur Phänologie siehe Kap. 3.

Unionicola (Pentatax) latilaminata Viets, 1911
[Vidrine (1996): Untergattung *Cookatax*]

Unionicola latilaminata: Viets (1912)
Unionicola latilaminata: Viets (1916)
Unionicola (Pentatax) latilaminata: Cook (1966)

K. Viets beschrieb das ♂ zunächst 1911 vorläufig und 1912 genauer (mit Abbildungen) aus einem großen Gebirgsbach bei Matánga nördlich Buea in Kamerun. K. Viets (1916) lagen Tiere von drei Fundorten nördlich von Duala in Kamerun vor, nach denen er nun das ♀ beschrieb und erneut das ♂ mit Abbildungen beider Geschlechter. Schließlich meldete K. Viets (1925) noch drei Fundorte im Süden von Kamerun.

Im SMF sind von diesem Material in der Sammlung K. Viets acht Präparate vorhanden, insgesamt 3 ♂♂ und 4 ♀♀. Nach den Funddaten hat von diesen nur 1 ♂ der Erstbeschreibung (K. Viets 1911) und der Nachbeschreibung (K. Viets 1912) zugrunde gelegen. Dieser Holotypus ist auf die beiden K. Viets-Präp. 1023 und 1128 aufgeteilt. In Präp. 1023 liegen zwei Beine (linkes I.B. und linkes IV.B.), die rechte Palpe, das Genitalskelett und eine Chelicere. Die übrigen Teile enthält Präp. 1128.

Die in K. Viets (1912) abgebildete Ventralansicht muss vor der Einbettung gezeichnet worden sein, während die gezeichnete linke Palpe und die Napfplatten in Präp. 1128 liegen. Die mitgezeichnete Bruchstelle der abgetrennten Napfplatten ist im Präparat zu sehen, auch wenn die Napfplatten jetzt noch weiter zerbrochen sind.

Die beiden Holotypus-Präparate 1023 und 1128 tragen die von K. Viets aufgetragene Beschriftung „Type". Aber auch die K. Viets (1916) zugrunde liegenden fünf Präparate (jeweils ♂ und ♀ von zwei Fundorten und ein ♀ vom dritten Fundort) tragen Typus-Aufschriften von K. Viets: die 3 ♀♀ jeweils „Type" und die beiden ♂♂ „Cotype". Diese fünf Präparate sind jedoch keine Syntypen, da sie nicht der Erstbeschreibung der Art von 1911 zugrunde lagen, auf die K. Viets die Determination ausdrücklich bezog.

Cook (1966) fand 2 ♀♀ in Liberia, gab die Maße von Palpe und I.B. an und bildete vor allem die charakteristischen Napfplatten des ♀ mit seinen überlangen Stechborsten

Tab. 6. *Unionicola latilaminata*, Maße der Extremitätenglieder in µm. – Abkürzungen siehe Kap. 2.

Unionicola latilaminata	P		I.B.				II.B.				III.B.				IV.B.				III.+ IV.Cp.		Np.
	4	5	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	L	B	L
Holotypus, ♂, K. Viets-Präp. 1023 + 1128, Kamerun	76	49	157	198	147	152	186	268	265	206	164	194	215	161	161	195	244	243	206	144	
N'Zi, 5 ♂♂, Mittelwerte, Präp. 1127–1131	77	49	154	204	158	161	204	271	279	224	168	197	218	184	171	210	261	269	222	147	99
N'Zi, 5 ♂♂, Maxima, Präp. 1127–1131	86	52	166	226	170	168	219	289	316	339	185	217	232	198	185	224	273	280	233	149	102
N'Zi, 5 ♂♂, Minima, Präp. 1127–1131	74	45	141	186	147	154	187	259	262	213	156	190	201	170	159	197	250	247	212	146	98
N'Zi, 11 ♀♀, Mittelwerte, Präp. 1030, 1117–1126	93	56	186	246	184	185	232	319	324	263	202	232	259	213	200	243	296	307	254	166	
N'Zi, 11 ♀♀, Maxima, Präp. 1030, 1117–1126	104	59	200	257	192	198	243	334	334	278	213	242	268	225	207	253	305	324	267	176	
N'Zi, 11 ♀♀, Minima, Präp. 1030, 1117–1126	86	48	177	228	177	173	212	297	310	252	188	212	243	208	190	224	273	292	237	148	
3 ♂♂, Mittelwerte, K. Viets-Präp. 1023, 1128, 1810,1904, Kamerun	71	45	145	185	138	147	174	250	254	197	158	183	200	160	151	180	229	233	201	138	
4 ♀♀, Mittelwerte, K. Viets-Präp. 1811, 1903, 1833, 3166, Kamerun	89	55	177	232	171	170	215	322	319	242	185	224	242	195	180	223	285	287	234	156	
nach Cook (1966), 2 ♀♀, Mittelwerte, Liberia	102	60	204	280	204	203															

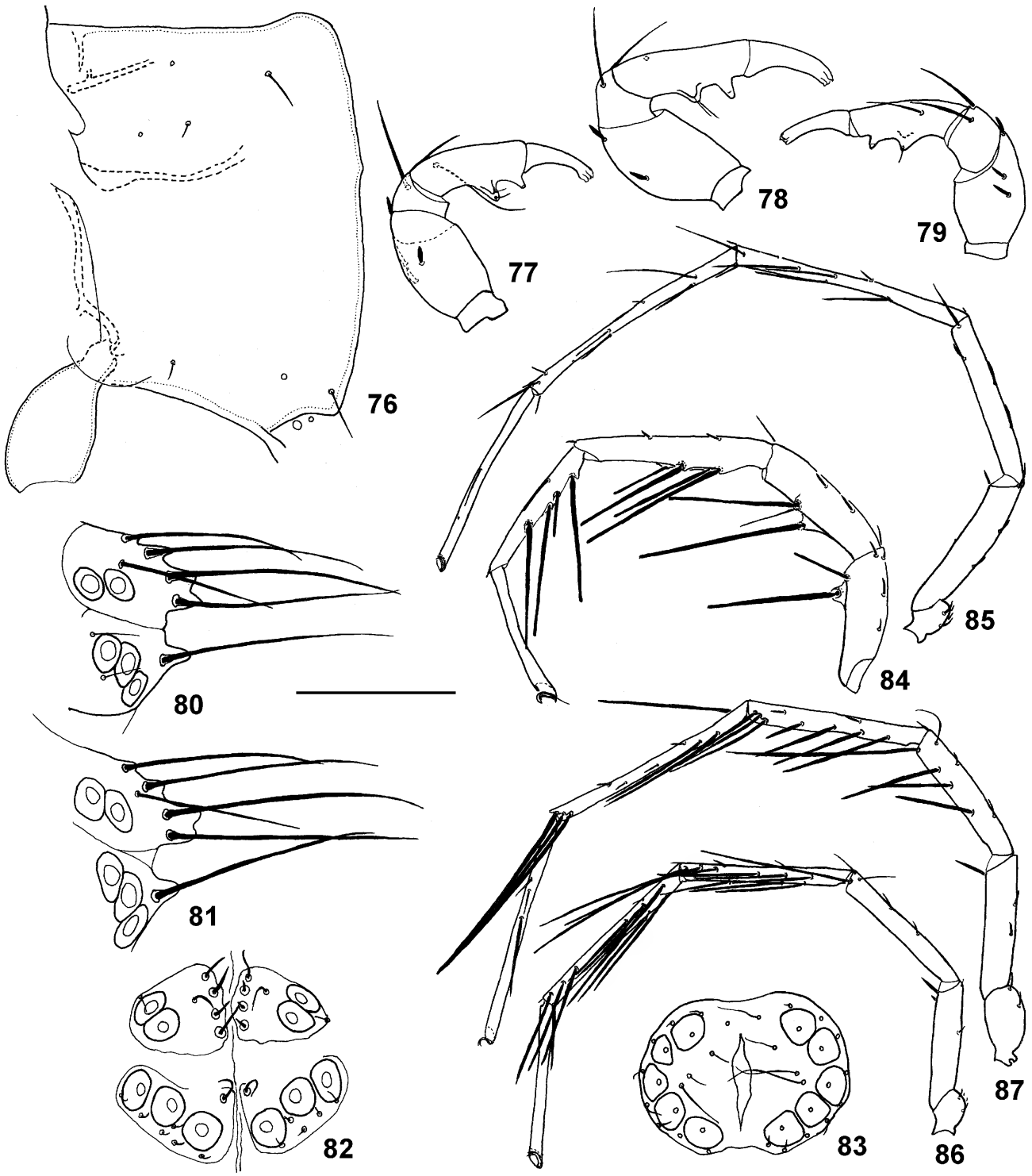

Abb. 76–87. *Unionicola latilaminata*. – **76**. ♀, III.+IV.Cp., Präp. 1122. **77**. Holotypus, ♂, linke Palpe von innen, K. VIETS-Präp. 1128. **78**. ♀, linke Palpe von innen, Präp. 1117. **79**. ♂, linke Palpe von außen, Präp. 1129. **80**. ♀, Napfplatten von der Seite, Präp. 1117. **81**. ♀, Napfplatten von der Seite, Präp. 1118. **82**. ♀, Napfplatten, Präp. 1121. **83**. ♂, Napfplatten, Präp. 1131. **84**. ♀, rechtes 1. Bein von vorne, Präp. 1124. **85**. ♀, linkes 2. Bein von hinten, Präp. 1117. **86**. ♀, linkes 3. Bein von hinten, Präp. 1117. **87**. ♀, linkes 4. Bein von hinten, Präp. 1117. – Maßstrich: 100 µm (76–83), 200 µm (84–87).

erstmalig von der Seite ab. Nur so ist ihre Einmaligkeit innerhalb der Gattung *Unionicola* eindeutig zu erkennen.

In der Drift des N'Zi wurden 5 ♂♂ und 11 ♀♀ gefangen. Beim ♀ tragen die charakteristisch aufgebogenen Mittelränder der beiden vorderen Napfplatten jeweils vier kräftige Stechborsten, die außergewöhnlich lang sind (bis zu 162 µm). Üblich sind hier bei den anderen *Unionicola*-Arten nur zwei deutlich kürzere Stechborsten. Hinzu kommt bei *U. latilaminata* auf den vorderen Napfplatten noch eine etwas abseits stehende weitere, aber etwas schwächere Borste. Die hinteren Napfplatten tragen auf ihrem aufgebogenen Mittelrand, wie bei *Unionicola* üblich, eine Stechborste, die aber auch hier fast so kräftig und überlang ist, wie die auf den vorderen Napfplatten (Abb. 80–82).

Der Holotypus und die sechs weiteren von K. VIETS aus Kamerun erhaltenen Tiere wurden neu vermessen (Tab. 6). Die Proportionen der Extremitätenglieder zueinander zeigen keine charakteristischen Abweichungen zu denen der Tiere aus dem N'Zi. Sowohl die ♂♂ als auch die ♀♀ sind im Durchschnitt etwas kleiner als die aus dem N'Zi. Auch in den Palpen sind keine wesentlichen Unterschiede zu sehen (Abb. 77–79).

Die beiden von COOK (1966) aus Liberia beschriebenen ♀♀ sind dagegen etwas größer als die aus dem N'Zi. COOK zeichnete in seiner Abb. 496 statt der vier überlangen Stechborsten auf den aufgebogenen Mittelrändern der vorderen Napfplatten deren fünf und nennt sie auch im Text. Bei dieser einen Borste mehr dürfte es sich um eine individuelle Variation handeln.

Die Körper der vier erhaltenen ♀♀ von K. VIETS sind leider nur unzergliedert eingebettet. Man sieht, wie von ihm 1916 beschrieben, dass die Napfplatten „am äußersten Hinterende des Körpers" liegen und „dessen zugespitzte, kegelförmige Verlängerung" bilden. Die langen „Bosten vereinigen sich zu einem 175 µ langen Büschel; dadurch erscheint der Körper hinten noch spitzer." Die Anzahl der Borsten ist jedoch durch die Endlage bei der genau ventralen Ansicht in den Präparaten nicht mit Sicherheit zu ermitteln.

Idiosomagrößen des N'Zi-Materials: ♂♂: 479 × 355 µm bis 660 × 544 µm (n = 5), ♀♀: 434 × 346 µm bis 808 × 607 µm (n = 11). K. VIETS (1911, 1912) gab für das ♂ 475 × 370 µm an und K. VIETS (1916) für das ♀ 600 × 390 µm.

Die 16 im N'Zi gefundenen *U. latilaminata* kamen in der Tagdrift (2 ♂♂, 8 ♀♀) und in der Nachtdrift (3 ♂♂, 3 ♀♀) vor. Die Art wurde nur im Januar und im Februar in der Drift des N'Zi gefangen, jedoch an allen fünf Untersuchungsstationen: Tinbé: 1 ♀; Fetekro: 2 ♂♂, 2 ♀♀; Ouokoukro: 1 ♂, 2 ♀♀; Kolomikro: 1 ♀; Bocanda: 2 ♂♂, 5 ♀♀.

Unionicola (Pentatax) megalopsis Viets, 1925
[VIDRINE (1996): Untergattung *Unionicola*]

K. VIETS (1925) beschrieb ♀ und ♂ aus Kamerun. Die Art wurde seither nicht wieder gefunden. Erhalten ist in der Sammlung K. VIETS im SMF ein Präparat (3170 „Kamerun, Fluß Onkútu, 19.I.1916."), das mit „Type" bezeichnet ist und ein ♀ und ein ♂ enthält. Von diesen beiden Syntypen wird das ♀ hiermit als Lectotypus festgelegt,

Tab. 7. *Unionicola megalopsis*, Maße der Extremitätenglieder in µm. * = kleine ♂♂ mit Napfplatten wie beim Paralectotypus (Abb. 107, 108, 93); ** = relativ kleine ♂♂ mit Napfplatten, wie sie WALTER (1937) für *U. chappuisi* abbildet (Abb. 105, 106). – Abkürzungen siehe Kap. 2.

Unionicola megalopsis	P		I.B.				II.B.				III.B.				IV.B.				III.+ IV.Cp.		Np.
	4	5	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	L	B	L
Lectotypus, ♀, K. VIETS-Präp. 3170, Kamerun	46	44	98	117	–	–	92	110	114	–	88	104	122	–	92	109	134	–	164	120	
Paralectotypus, ♂, K. VIETS-Präp. 3170, Kamerun	39	41	88	109	117	110	84	98	114	95	78	93	119	107	81	100	124	115	132	105	–
N'Zi, 10 ♂♂, Mittelwerte, Präp. 808–817	56	58	117	151	157	134	108	135	150	134	104	132	154	135	119	148	172	155	171	137	100
N'Zi, 10 ♀♀, Mittelwerte, Präp. 825–834	57	59	122	156	162	131	112	142	152	137	111	139	157	135	125	153	177	160	184	148	
N'Zi, 2 ♂♂, Mittelwerte, Präp. 818–819 *	43	45	84	102	112	91	82	103	114	103	78	100	117	102	88	106	130	117	142	112	103
N'Zi, 2 ♂♂, Mittelwerte, Präp. 820–821 **	52	53	101	134	144	123	102	126	134	124	97	121	138	119	109	132	160	139	175	143	103

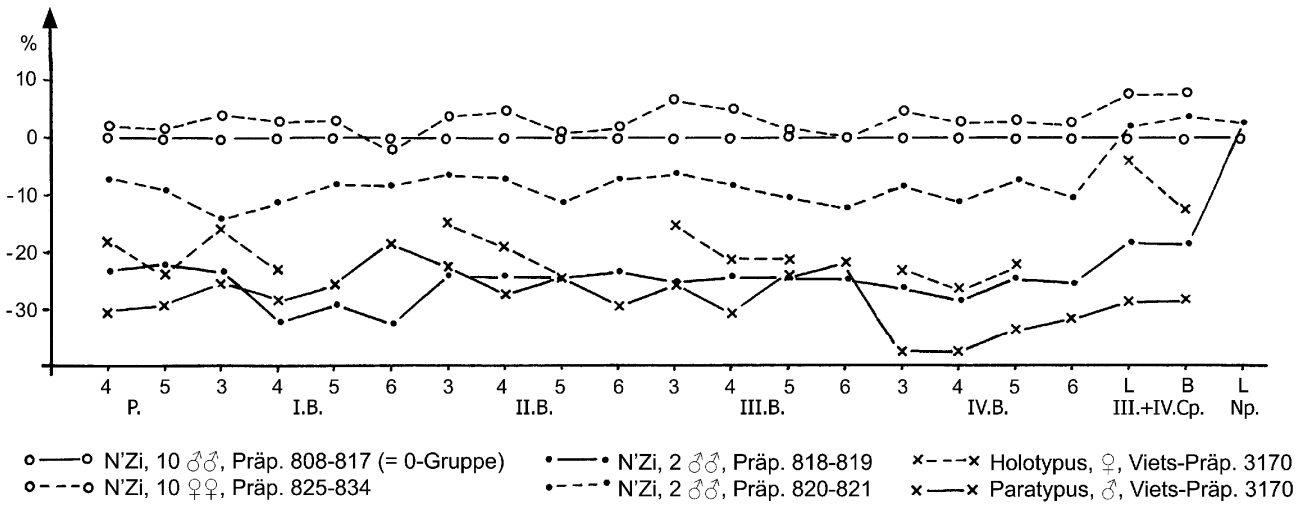

Abb. 88. Proportionalitätsdiagramm von *Unionicola megalopsis*. Vergleich von Tieren aus dem N'Zi mit den Typusexemplaren von K. VIETS (1925) aus Kamerun.

da K. VIETS (1925) das ♀ ausführlicher und vor dem ♂ beschrieben hat. Das ♂ wird damit zum Paralectotypus. Die Typusexemplare wurden neu vermessen (Tab. 7) und die Napfplatten des ♂ gezeichnet (Abb. 109).

Aus dem N'Zi der Elfenbeinküste kommen insgesamt 38 ♂♂ und 86 ♀♀, die ich zu *U. megalopsis* stelle. Das Proportionalitätsdiagramm (Abb. 88) zeigt, dass keine wesentlichen Unterschiede in den Extremitäten-Proportionen vorhanden sind, auch wenn Lectotypus und Paralectotypus von K. VIETS sehr klein sind und die Maße der Extremitätenglieder teilweise sogar etwas unterhalb der Variationsbreite der Tiere aus dem N'Zi liegen.

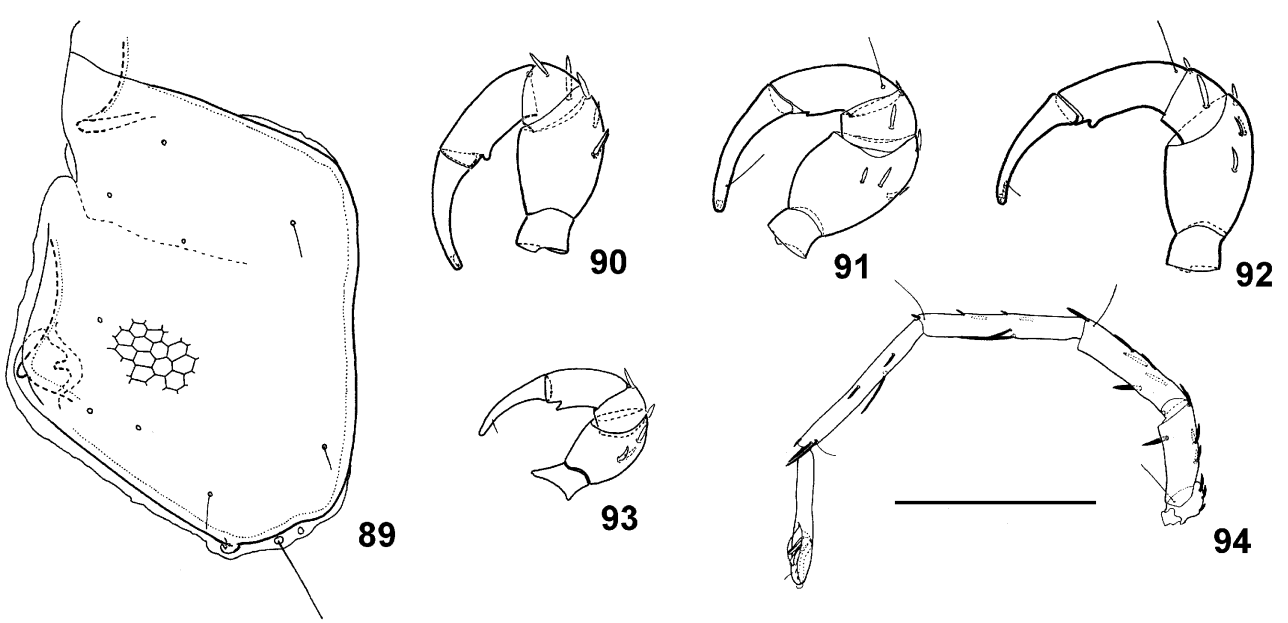

Abb. 89–94. *Unionicola megalopsis*. – **89**. ♂, III.+IV.Cp., Präp. 816. **90**. ♂, rechte Palpe von innen, Präp. 816. **91**. ♂, linke Palpe von außen, Präp. 817. **92**. ♀, linke Palpe von außen, Präp. 837. **93**. ♂, linke Palpe von außen, Präp. 819. **94**. ♂, linkes 1. Bein von hinten, Präp. 816. – Maßstrich: 100 µm (89–93), 200 µm (94).

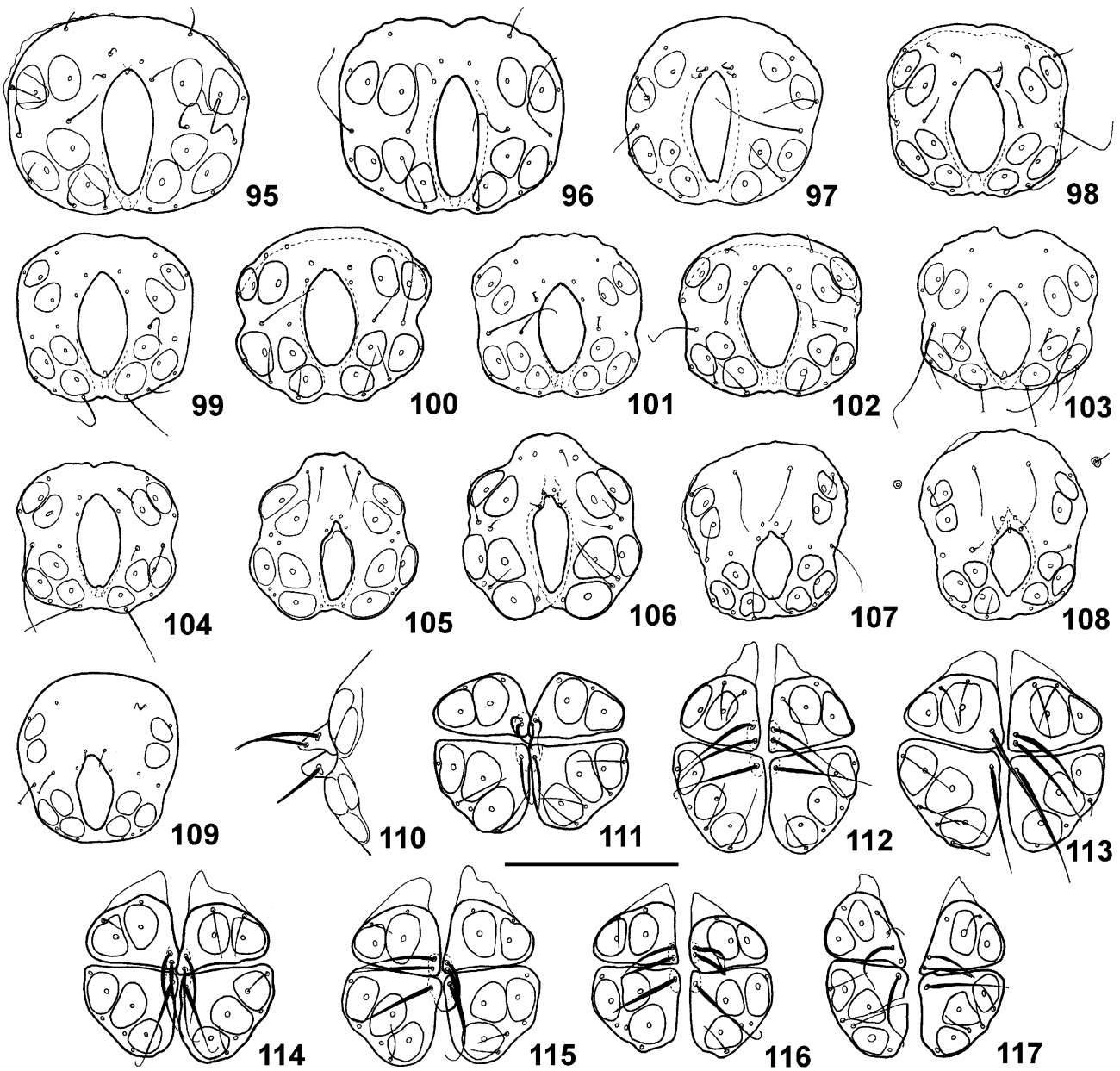

Abb. 95–117. *Unionicola megalopsis*, Napfplatten. – **95**. ♂, Präp. 816. **96**. ♂, Präp. 814. **97**. ♂, Präp. 817. **98**. ♂, Präp. 812. **99**. ♂, Präp. 810. **100**. ♂, Präp. 813. **101**. ♂, Präp. 809. **102**. ♂, Präp. 822. **103**. ♂, Präp. 824. **104**. ♂, Präp. 808. **105**. ♂, Präp. 820. **106**. ♂, Präp. 821. **107**. ♂, Präp. 819. **108**. ♂, Präp. 818. **109**. Paralectotypus, ♂, K. VIETS-Präp. 3170. **110**. ♀, Napfplatten von der Seite, Präp. 924. **111**. ♀, Präp. 832. **112**. ♀, Präp. 839. **113**. ♀, Präp. 834. **114**. ♀, Präp. 836. **115**. ♀, Präp. 837. **116**. ♀, Präp. 829. **117**. ♀, Präp. 828. – Maßstrich: 100 µm.

Die Napfplatten mit im Normalfall 10 Näpfen sind in ihrer Form ausgesprochen variabel. Bei den ♂♂ treten auch bei zwei Tieren nach vorne erweiterte Napfplatten auf (Abb. 107–108), wie sie K. VIETS (1925: Abb. 27) in seiner Erstbeschreibung für *U. megalopsis* abbildet. Bei zwei weiteren Tieren tritt sogar die Form auf (Abb. 105–106), wie sie WALTER (1937: Abb. 2) für *U. chappuisi* aus Angola zeigt. Diese 4 ♂♂ und die beiden Typusexemplare aus Präp. 3170 von K. VIETS sind relativ kleine Tiere (Tab. 7).

Bei den ♀♀ können die Napfplatten mehr in die Breite (Abb. 111) oder in die Länge gehen (Abb. 112). Die drei Näpfe der hinteren Platten können in einer Reihe

liegen (Abb. 111–114) oder im Dreieck angeordnet sein (Abb. 116); beides kommt auch bei ein und demselben Tier vor (Abb. 115). An den vorderen Napfplatten können nach vorne sekundäre Chitin-Anlagerungen erfolgen (Abb. 112–117), wie sie bei älteren Individuen anderer Arten auch oft auftreten (HEVERS 1978b: 72). Dadurch kann eine Napfplattenform entstehen, wie sie K. VIETS (1925: Abb. 26) für den Lectotypus abbildet.

U. vietsi ist *U. megalopsis* sehr ähnlich, unterscheidet sich aber vor allem durch im Verhältnis zu den Beingliedern kürzere P.5 und durch im Verhältnis zu den IV.B.4 längere IV.B.6. (vgl. Revision von *U. vietsi* in Kap. 5).

Idiosomagrößen des N'Zi-Materials: ♂♂: 337 × 268 µm bis 605 × 209 µm (n = 17), ♀♀: 430 × 330 µm bis 740 × 579 µm (n = 17).

U. megalopsis wurde in den Monaten Januar bis März und Mai bis September 1977 in 125 Individuen (38 ♂♂, 87 ♀♀) gefangen. Die Art kam sowohl in der Tagdrift (24 ♂♂, 44 ♀♀) als auch in der Nachtdrift (14 ♂♂, 43 ♀♀) vor. Sie wurde in der Drift aller fünf Untersuchungsstationen im N'Zi gefangen: Tinbé: 9 ♂♂, 7 ♀♀; Fetekro: 5 ♀♀; Ouokoukro: 20 ♂♂, 31 ♀♀; Kolomikro: 8 ♂♂, 41 ♀♀; Bocanda: 1 ♂, 3 ♀♀.

Unionicola (Pentatax) minuta Viets, 1916
[VIDRINE (1996): Untergattung *Unionicola*]

Unionicola minuta: WALTER (1935)

K. VIETS (1916) beschrieb ♀ und ♂ aus Kamerun von drei Fundorten und bildete das ♀ ab; es sind bis jetzt die einzigen Abbildungen der Art. Nur WALTER (1935) beschrieb noch 1 ♀ und 1 Nymphe aus Französisch Westafrika (heute Burkina Faso); weitere Funde sind nicht bekannt.

Die Typusserie befindet sich in der Sammlung K. VIETS im SMF. Sie besteht aus 2 ♀♀ und 1 ♂. Alle sind mit „Type" bezeichnet, ein Holotypus wurde nicht festgelegt. K. VIETS (1916) beschrieb das ♀ vor dem ♂; die Abbildungen können nur nach dem ♀ in Präp. 1838 gezeichnet worden sein, auch wenn Borsten auf Palpe und Napfplatten z. T. anders gelegt oder ergänzt wurden. Es wird daher das ♀ in K. VIETS-Präp. 1838 als Lectotypus von *Unionicola minuta* festgelegt. Er trägt die Daten: „Kamerun, Bunge-Fluß, 21.V.1914". Die übrigen beiden Tiere der Typusserie werden damit zu Paralectotypen: K. VIETS-Präp. 1933: ♀, Kamerun, Huga-Fluß, 21.V.1914; K. VIETS-Präp. 1940: ♂, Kamerun, Ngombe-Fluß, 23.III.1913. Die Tiere der Typusserie wurden neu vermessen, die Maße sind in Tab. 8 angegeben.

U. minuta wurde im N'Zi lediglich in zwei Exemplaren gefangen (1 ♂, 8.VI.1977 Tagdrift, bei Ouokoukro,

Tab. 8. *Unionicola minuta*, Maße der Extremitätenglieder in µm. – Abkürzungen siehe Kap. 2.

Unionicola minuta	P		I.B.				II.B.				III.B.				IV.B.				III.+ IV.Cp.		Np.
	4	5	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	L	B	L
Lectotypus, ♀, K. VIETS-Präp. 1838, Kamerun	70	37	85	117	112	98	104	127	146	132	92	109	134	126	96	120	151	148	107	103	
Paralectotypus, ♀, K. VIETS-Präp. 1933, Kamerun	62	37	80	110	114	93	96	116	139	129	87	103	129	122	94	115	149	145	115	106	
Paralectotypus, ♂, K. VIETS-Präp. 1940, Kamerun	73	38	88	120	119	101	110	137	153	140	97	110	144	129	99	124	–	–	122	109	–
N'Zi, ♂, Ouokoukro, 8.VI.1977, Präp. 943	78	45	101	137	145	125	125	147	175	158	108	126	157	144	114	143	178	171	127	120	105
N'Zi, ♀, Tinbé, 17.VIII.1977, Präp. 944	90	51	110	156	161	132	139	168	200	181	120	139	188	169	133	165	206	187	135	117	
♀, nach WALTER (1935), Burkina Faso	90	50																			

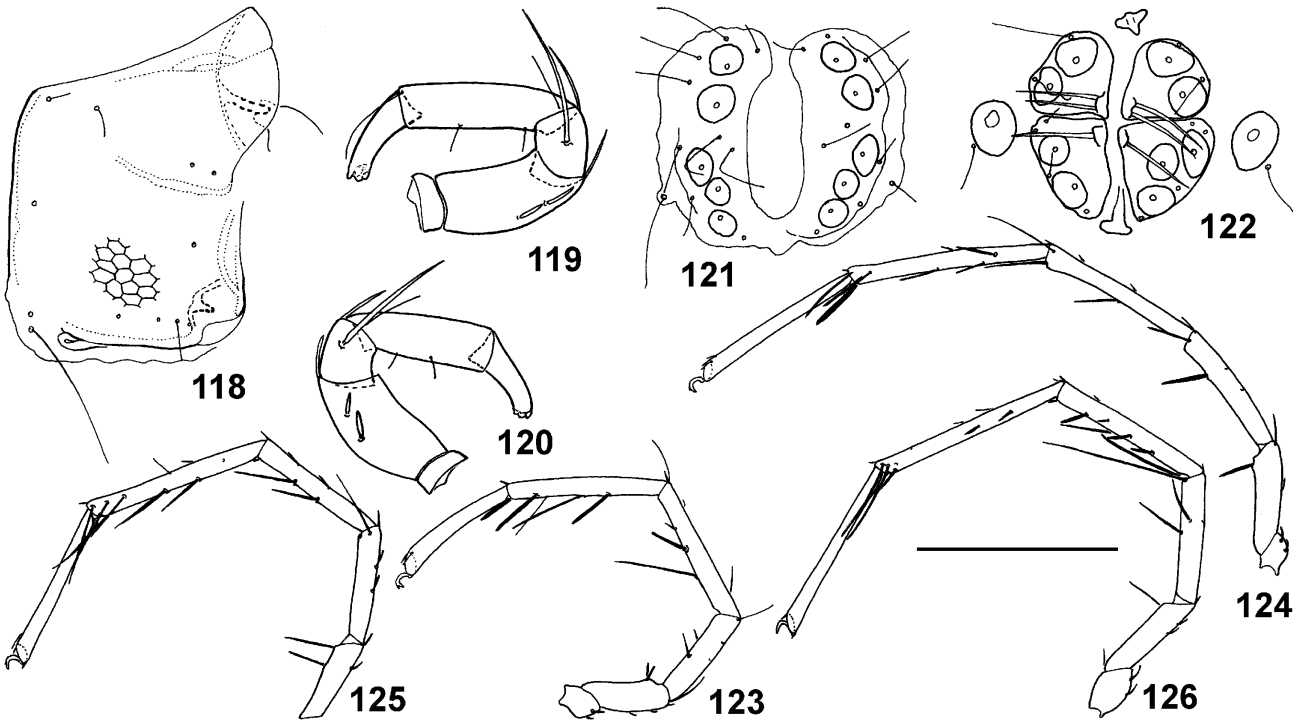

Abb. 118–126. *Unionicola minuta*. – **118**. ♀, III.+IV.Cp., Präp. 944. **119**. ♀, linke Palpe von außen, Präp. 944. **120**. ♂, rechte Palpe von außen, Präp. 943. **121**. ♂, Napfplatten, Präp. 943. **122**. ♀, Napfplatten, auf der rechten hinteren Platte ein Napf zu wenig, Präp. 944. **123**. ♀, 1. linkes Bein von hinten, Präp. 944. **124**. ♀, 2. linkes Bein von hinten, Präp. 944. **125**. ♀, 3. linkes Bein von hinten, Präp. 944. **126**. ♀, 4. linkes Bein von hinten, Präp. 944. – Maßstrich: 100 µm (118–122), 200 µm (123–126).

Präp. 943; 1 ♀, 17.VIII.1977 Nachtdrift, bei Tinbé, Präp. 944). Alle Beinpaare tragen nur wenige Schwimmborsten, die auch nicht, wie sonst bei *Unionicola* vielfach üblich, besonders verstärkt inseriert sind (Abb. 123–126).

K. VIETS (1916) hat insbesondere die Palpe sehr genau mit allen Borsten abgebildet. Auffällig ist das Fehlen sämtlicher Höcker oder Zapfen auf der Beugeseite des P.4. VIETS lag ein sehr kleines ♀ vor, wie bereits WALTER (1935) bemerkt. Das vorliegende ♀ aus dem N'Zi stimmt in der Idiosomagröße (425 × 287 µm) und der Palpusgröße (Tab. 8) gut mit WALTERS Tier überein. Es hat auf der linken hinteren Napfplatte einen Napf zu wenig (Abb. 122).

Die Napfplatten des ♂ stoßen vorne nicht zusammen (Abb. 121), wie auch K. VIETS (1916) angibt; die Umrisslinien sind unscharf. Es handelt sich offenbar um ein altes ♂ (Idiosoma 458 × 392 µm), bei dem sich um die Napfplatten sekundär Chitin angelagert hat.

Obgleich das vorliegende ♀ von der Idiosomagröße her etwas kleiner ist als das ♂ (458 × 393 µm), sind die Maße seiner Extremitätenglieder deutlich größer (Tab. 8). Das ♀ war mit nur einem Ei oviger, hatte also seine maximale Idiosoma-Größe noch nicht erreicht. Das Ei misst nur 63 × 50 µm und ist damit deutlich kleiner, als die von K. VIETS (100 µm Länge) und WALTER (125 µm Länge) gemessenen Eier; es war offenbar noch nicht voll ausgebildet.

Unionicola (Pentatax) nziensis **n. sp.**

Holotypus: ♂, Westafrika, Elfenbeinküste, Fluss N'Zi, bei Ouokoukro, 8.VI.1977, Tagdrift, leg. BERNHARD STATZNER, Präparat 844, SMF.

Paratypen: 9 ♂♂, 10 ♀♀, alle Westafrika, Elfenbeinküste, Fluss N'Zi, Mai bis September 1977, Driftfänge, leg. BERNHARD STATZNER, Präparate 841–843, 845–859, SMF.

Derivatio nominis

Nach dem Fluss N'Zi in der Elfenbeinküste, aus dem die Art erstmals gefangen wurde.

Diagnose

Die Art gehört innerhalb der Untergattung *Pentatax* Thor, 1922 zur *Unionicola borgerti*-Gruppe mit verbreiterten, stumpfen Krallen am 1. Beinpaar. Sie ist *U. vietsi* und *U. megalopsis*, sehr ähnlich, aber größer als diese und durch ihre Proportionalitätskurve im Proportionalitätsdiagramm (Abb. 209) eindeutig von ihnen zu trennen. Insbesondere fällt das im Verhältnis zum I.B.4 und I.B.6 sehr viel längere I.B.5 auf. Auch nach den Absolutmaßen des I.B.5 ist *U. nziensis* gut von *U. megalopsis* und erst recht von *U. vietsi* zu trennen: Bei *U. nziensis* sind die I.B.5 bei den ♂♂ länger als 200 µm und bei den ♀♀ länger als 220 µm (Tab. 9). Zeichnungen siehe Abb. 127–142.

Tab. 9. *Unionicola nziensis* n. sp., Maße der Extremitätenglieder in µm. – Abkürzungen siehe Kap. 2.

Unionicola nziensis n. sp.	P		I.B.				II.B.				III.B.				IV.B.				III.+ IV.Cp.		Np.
	4	5	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	L	B	L
Holotypus, ♂, N'Zi, 8.VI.1977, Präp. 844	74	74	147	197	246	198	138	178	215	174	142	174	205	169	162	204	241	210	212	172	116
N'Zi, 10 ♂♂, Mittelwerte, Präp. 840–849	72	76	143	195	245	191	139	182	213	171	140	176	206	170	160	203	240	207	208	171	118
N'Zi, 10 ♂♂, Maxima, Präp. 840–849	77	82	153	205	258	203	145	189	223	180	148	183	215	179	172	215	250	214	220	179	124
N'Zi, 10 ♂♂, Minima, Präp. 840–849	66	66	133	181	224	173	130	170	195	160	130	166	192	156	148	189	222	190	185	164	111
N'Zi, 10 ♀♀, Mittelwerte, Präp. 850–859	78	83	154	210	260	204	148	197	229	184	152	192	222	178	177	220	257	219	224	185	
N'Zi, 10 ♀♀, Maxima, Präp. 850–859	85	89	165	224	280	215	161	212	243	199	165	200	235	195	187	233	278	237	236	195	
N'Zi, 10 ♀♀, Minima, Präp. 850–859	75	77	147	201	245	188	142	188	215	177	143	185	213	170	166	205	240	209	205	174	

Idiosomagrößen: ♂♂: 505 × 385 µm bis 768 × 645 µm (n = 13), ♀♀: 518 × 422 µm bis 795 × 590 µm (n = 12).

Phänologie/Verbreitung

U. nziensis wurde in den Monaten Mai bis September 1977 in 82 Individuen (22 ♂♂, 60 ♀♀) im N'Zi gefangen. Sie war teilweise zusammen mit *U. megalopsis* in denselben Proben vertreten. *U. nziensis* kam sowohl in der Tagdrift (18 ♂♂, 23 ♀♀) als auch in der Nachtdrift (4 ♂♂, 37 ♀♀) vor. Sie wurde an allen fünf Untersuchungsstationen im N'Zi gefangen: Tinbé: 7 ♂♂, 17 ♀♀; Fetekro: 1 ♂, 14 ♀♀; Ouokoukro: 12 ♂♂, 27 ♀♀; Kolomikro: 1 ♂, 2 ♀♀; Bocanda: 1 ♂.

Unionicola (Pentatax) statzneri n. sp.

Holotypus: ♂, Westafrika, Elfenbeinküste, Fluss N'Zi, bei Ouokoukro, 15.II.1977, Nachtdrift, leg. Bernhard Statzner, Präparat 945, SMF.

Paratypen: 12 ♂♂, 10 ♀♀, 10 Nymphen, alle Westafrika, Elfenbeinküste, Fluss N'Zi, Januar und Februar 1977, Driftfänge, leg. Bernhard Statzner, Präparate 946–947, 1132–1150, 1152–1161, SMF.

Derivatio nominis

Nach Dr. Bernhard Statzner, Direktor am CNRS (Écologie des Hydrosystèmes Fluviaux, Université Lyon I) in Villeurbanne, Frankreich, der das vorliegende Material aus dem N'Zi in der Elfenbeinküste über einen vollen Jahrszyklus hin systematisch sammelte.

Diagnose

Die Art gehört zur Untergattung *Pentatax* Thor, 1922 (siehe Thor 1922). Sie zeichnet sich durch einen außerordentlich kräftigen Beugeseitenzahn am P.5, durch kammartige innere Nebenzinken an den beiden Krallen der I.–III.B. und bei den ♀♀ auch der IV.B. aus. Sie ist durch einen Sexualdimorphismus ausgezeichnet, bei dem das 4. Beinpaar des ♂ umgebildet ist. Diese Merkmale sind von keiner anderen *Unionicola*-Art bekannt. Maße in Tab. 10, Zeichnungen siehe Abb. 143–158.

Beschreibung

Die Palpen von *U. statzneri* sind relativ schlank, haben aber ein kräftiges P.5 mit 3 Zähnen, von denen der Beugeseitenzahn besonders mächtig ausgebildet ist (Abb. 144–145), auch bereits bei den Nymphen (Abb. 156). Die Beine sind reich mit langen Schwimmhaaren und z. T. besonders breiten, paddelförmigen Borsten besetzt. Die Krallen mit kleiner äußerer Nebenzinke tragen als Besonderheit innen eine Reihe gleichförmiger kammartig angeordneter Nebenzinken (Abb. 149–152, 155). Auch bereits die Krallen der Nymphen besitzen auf der Beugeseite diese kammartigen Nebenzinken (Abb. 157). Ähnliche innere Nebenzinken der Krallen wurden bislang lediglich bei der nordamerikanischen *U. (Unionicola) pectinata* (Wolcott, 1898) für das 1. Beinpaar beschrieben und in Wolcott (1898: fig. 1, 1899: fig. 8) für ein ♂ abgebildet.

Die IV.B. der ♂♂ sind auffällig umgestaltet. Die IV.B.2–6 sind verkürzt; das IV.B.6 um über ein Drittel

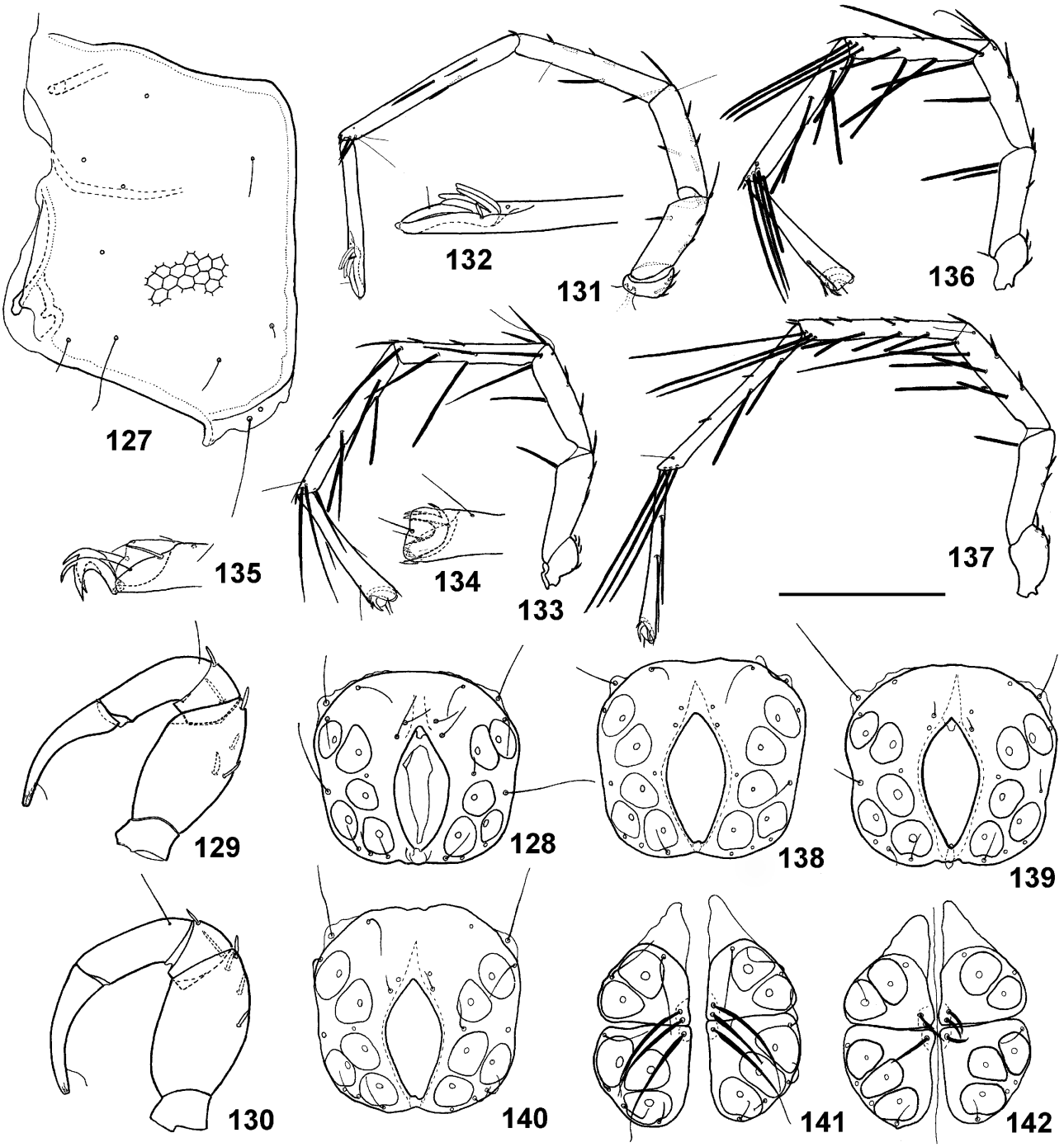

Abb. 127–142. *Unionicola nziensis* n. sp. – **127**. Holotypus, ♂, III.+IV.Cp., Präp. 844. **128**. Holotypus, ♂, Napfplatten, Präp. 844. **129**. Holotypus, ♂, rechte Palpe von innen, Präp. 844. **130**. ♀, rechte Palpe von innen, Präp. 850. **131**. Holotypus, ♂, linkes 1. Bein von hinten, Präp. 844. **132**. Holotypus, ♂, Ende des linken I.B.6 von hinten, Präp. 844. **133**. Holotypus, ♂, linkes 2. Bein von hinten, Präp. 844. **134**. Holotypus, ♂, Ende des linken II.B.6 von hinten, Präp. 844. **135**. ♂, Ende des linken II.B.6 von vorne, Präp. 926. **136**. Holotypus, ♂, linkes 3. Bein von hinten, Präp. 844. **137**. Holotypus, ♂, linkes 4. Bein von hinten, Präp. 844. **138**. ♂, Napfplatten, Präp. 841. **139**. ♂, Napfplatten, Präp. 843. **140**. ♂, Napfplatten, Präp. 848. **141**. ♀, Napfplatten, Präp. 859. **142**. ♀, Napfplatten, Präp. 857. – Maßstrich: 100 µm (127–130, 132, 134, 135, 138–142), 200 µm (131, 133, 136–137).

Tab. 10. *Unionicola statzneri* n. sp., Maße der Extremitätenglieder in µm. – Abkürzungen siehe Kap. 2.

Unionicola statzneri n. sp.	P		I.B.				II.B.				III.B.				IV.B.				III.+ IV.Cp.		Np.
	4	5	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	L	B	L
Holotypus, ♂, N'Zi, 15.II.1977, Präp. 945	88	65	130	165	200	184	171	205	223	175	147	190	229	170	97	127	173	106	165	175	–
N'Zi, 13 ♂♂, Mittelwerte, Präp. 945–947, 1132–1141	88	68	130	161	192	179	168	201	209	170	149	185	217	166	96	122	171	100	155	165	100
N'Zi, 13 ♂♂, Maxima, Präp. 945–947, 1132–1141	91	73	136	166	205	187	177	210	218	178	161	194	229	176	101	128	177	108	164	175	106
N'Zi, 13 ♂♂, Minima, Präp. 945–947, 1132–1141	85	63	123	146	173	162	166	185	175	157	130	169	196	157	89	107	153	92	142	140	91
N'Zi, 10 ♀♀, Mittelwerte, Präp. 948, 1142–1150	104	76	138	168	190	186	172	197	207	178	151	183	212	174	149	182	225	179	174	194	
N'Zi, 10 ♀♀, Maxima, Präp. 948, 1142–1150	112	82	145	180	204	200	180	212	219	192	161	195	226	188	159	197	236	198	195	213	
N'Zi, 10 ♀♀, Minima, Präp. 948, 1142–1150	95	70	129	162	175	171	163	186	194	164	140	167	203	166	136	167	211	162	155	175	
N'Zi, 10 Nymphen, Mittelwerte, Präp. 1152–1161	60	42	72	83	96	109	87	94	106	108	79	88	113	104	77	93	118	105	83	88	
N'Zi, 10 Nymphen, Maxima, Präp. 1152–1161	63	45	84	92	108	113	94	100	115	112	82	92	117	109	81	98	123	109	87	94	
N'Zi, 10 Nymphen, Minima, Präp. 1152–1161	54	39	66	74	80	98	75	82	95	98	70	80	105	94	65	85	109	96	69	79	

(Tab. 10). Die Zahl der Schwimmhaare und Borsten ist stark reduziert; die langen Haare des IV.B.5 sind an das distale Ende gerückt. Die Krallen sind verkleinert, ohne kammförmige Nebenzinken, aber sehr kräftig und kompakt und arbeiten anscheinend als Antagonisten gegen eine kräftige Borste an der distalen Beugeseitenecke des IV.B.6 (Abb. 153–154).

Idiosomagrößen: ♂♂: 427 × 242 µm bis 604 × 437 µm (n = 13), ♀♀: 460 × 296 µm bis 893 × 660 µm (n = 11), Nymphen: 360 × 273 µm bis 439 × 311 µm (n = 10).

Phänologie/Verbreitung

U. statzneri gehörte zu den vier am häufigsten in der Drift des N'Zi vorkommenden Milbenarten. Sie wurde in 453 Individuen gefangen (226 ♂♂, 175 ♀♀, 52 Nymphen), in der Tagdrift (113 ♂♂, 79 ♀♀, 34 Nymphen) und in der Nachtdrift (113 ♂♂, 96 ♀♀, 18 Nymphen). Die Art kam an allen fünf Untersuchungsstationen vor: Tinbé: 130 ♂♂, 75 ♀♀, 22 Nymphen; Fetekro: 2 ♂♂, 5 ♀♀; Ouokoukro: 18 ♂♂, 19 ♀♀, 10 Nymphen; Kolomikro: 13 ♂♂, 19 ♀♀, 13 Nymphen; Bocanda: 63 ♂♂, 57 ♀♀, 7 Nymphen. Zur Phänologie siehe Kap. 3.

Anmerkungen zum Sexualdimorphismus der Beine

Sexuell umgestaltete IV.B. der ♂♂ gibt es bei *Unionicola* verschiedentlich und in sehr unterschiedlicher Ausprägung. Sie reicht von kräftigeren und längeren Borsten am IV.B. des ♂ bei *U. (Coelaturicola) edwardsi* Vidrine, Bogan et Bastian-Stanford, 2008, einer in Muscheln vorkommenden Art Angolas (siehe Vidrine et al. 2008), bis zur extremen Verbiegung des IV.B.4 und monströs umgestalteten Borsten am IV.B.3 und IV.B.4 des ♂ von *U. (Pentatax) macani* Gledhill, 1985, die in Schnecken in Nigeria gefunden wurde (siehe Gledhill 1985).

Bei *U. (Neoatax) abnormipes* (Wolcott, 1898) und *U. (Neoatax) indistincta* (Wolcott, 1898) aus Nordamerika, die in Muscheln vorkommen, sind bei den ♂♂ vor allem die IV.B.5 verkürzt und umgebildet, weswegen Lundblad (1941) die eigene Untergattung *Neoatax* für die beiden Arten errichtete.

U. (Giselatax) lundbladi Viets, 1975 aus Australien besitzt im männlichen Geschlecht stark verkürzte IV.B.4, die einen eigentümlichen Borstenbesatz tragen. Wegen dieser Umgestaltungen stellte K. O. Viets (1975) eigens die Untergattung *Giselatax* auf.

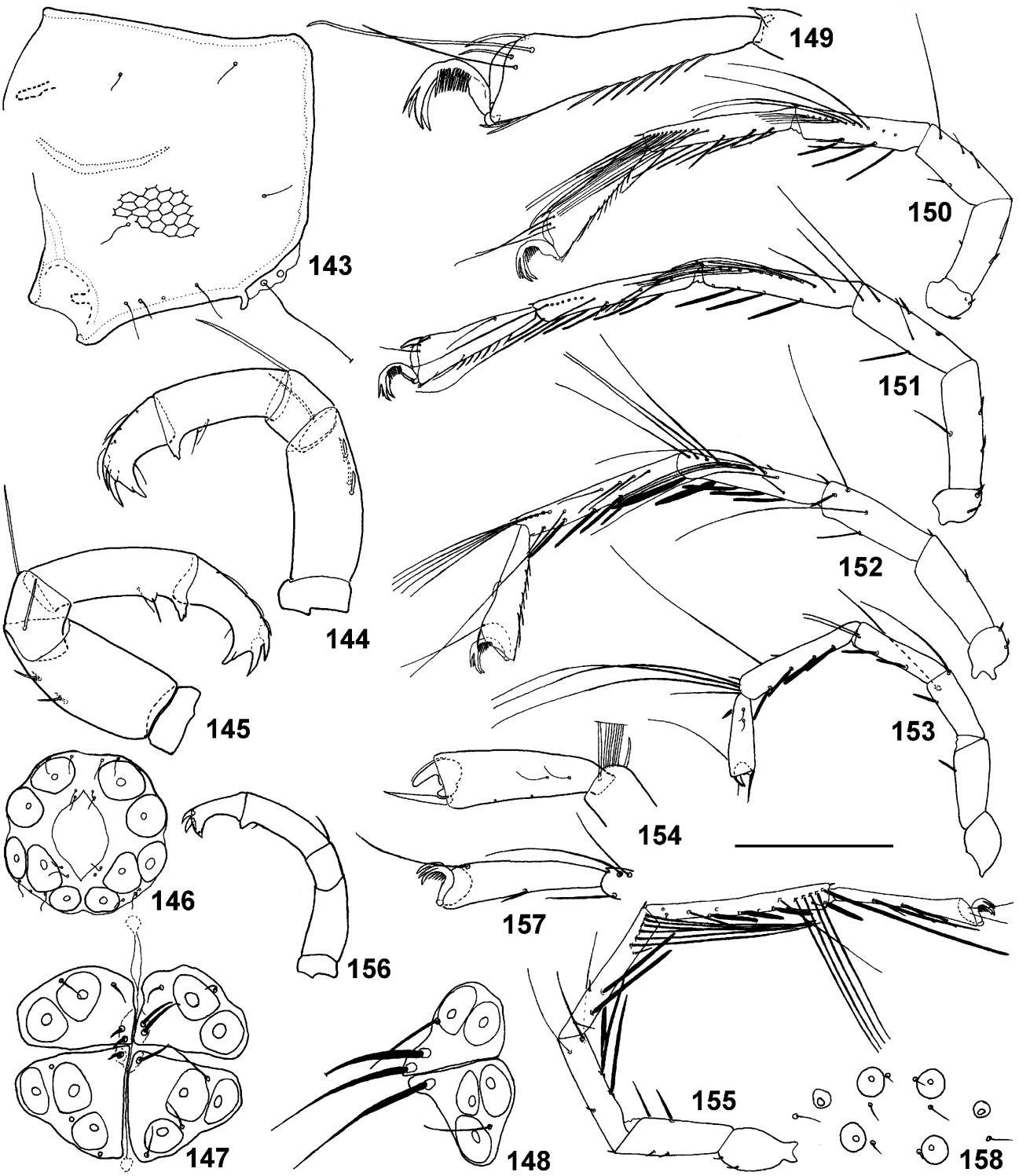

Abb. 143–158. *Unionicola statzneri* n. sp. – **143**. Holotypus, ♂, III.+IV.Cp., Präp. 945. **144**. Holotypus, ♂, linke Palpe von innen, Präp. 945. **145**. ♀, rechte Palpe von außen, Präp. 948. **146**. ♂, Napfplatten, Präp. 946. **147**. ♀, Napfplatten, Präp. 1142. **148**. ♀, Napfplatten von der Seite, Präp. 1150. **149**. Holotypus, ♂, linkes I.B.6 von hinten, Präp. 945. **150**. Holotypus, ♂, linkes 1. Bein von hinten, Präp. 945. **151**. Holotypus, ♂, linkes 2. Bein von hinten, Präp. 945. **152**. Holotypus, ♂, linkes 3. Bein von hinten, Präp. 945. **153**. Holotypus, ♂, linkes 4. Bein von hinten, Präp. 945. **154**. Holotypus, ♂, linkes IV.B.6 von hinten, Präp. 945. **155**. ♀, rechtes 4. Bein von hinten, Präp. 948. **156**. Nymphe, linke Palpe von außen, Präp. 1153. **157**. Nymphe, linkes 1.B.6 von hinten, Präp. 1153. **158**. Nymphe, 4 Näpfe nicht auf Napfplatten, sondern frei in der Haut, Präp. 1159. – Maßstrich: 100 µm (143–149, 154, 156–158), 200 µm (150–153, 155).

Der sexuellen Umgestaltung der Beine der ♂♂ wegen wurden sogar zwei neue Gattungen geschaffen, obgleich die ♀♀ wie normale *Unionicola* aussehen. *Vietsatax parasiticum* Uchida & Imamura, 1938 aus Japan ist ein Muschelparasit und hat als ♂ insbesondere umgestaltete IV.B.4 und einen verstärkten Borstenbesatz auf den IV.B.3–5 (siehe Imamura 1938). *Heteratax falcipes* Lundblad, 1941 aus Südafrika und dem Kongo besitzt als ♂ umgewandelte III.B.6 und IV.B.5–6 (Abbildungen in Lundblad 1945, 1949).

Die genaue Funktion dieser so unterschiedlich umgestalteten IV.B. der ♂♂ ist fast durchgehend unbekannt. Lediglich für eine einzige Art liegen ethologische Untersuchungen zur Sexualbiologie vor. Als erstmalig für *Unionicola* bei sechs Arten die Spermaübertragung durch Spermatophoren nachgewiesen wurde, war darunter auch die in Muscheln lebende *U. (Pentatax) intermedia*, deren IV.B. einen deutlichen Sexualdimorphismus zeigen, insbesondere die IV.B.4 der ♂♂ sind charakteristisch umgebildet. Da die Spermatophorenbildung und Spermaübertragung dieser Art innerhalb der Muschel erfolgen muss, die Spermatophore dort aber nicht abgesetzt werden kann, wird sie vom ♂ mit seinen hierzu speziell umgebildeten IV.B. ergriffen und gehalten. Das ♂ sucht dann mit dieser getragenen Spermatophore ein paarungswilliges ♀ auf und betupft dessen Genitalregion mit dem Sperma im Spermatophorenköpfchen (Hevers 1978a, 1978b).

Da solche Lebendbeobachtungen nur unter besonderen Hälterungs- und Beobachtungsbedingungen im Labor möglich sind, die auf Sammelexpeditionen nicht gegeben sind, wird die Funktion der umgestalteten Beine nur selten zu ermitteln sein. Die Umgestaltungen sind so vielfältig, dass auch die Funktionen recht verschieden sein werden. Man wird daher davon ausgehen müssen, dass sich der Sexualdimorphismus der IV.B. im Laufe der Evolution mehrfach unabhängig voneinander innerhalb der Gattung *Unionicola* herausgebildet hat. Er dürfte zumindest teilweise durch das Leben in Muscheln oder Schnecken bedingt sein.

4.4 Untergattung *Unionicola* Haldeman, 1842

Unionicola (Unionicola) inflexa Viets, 1921
[Vidrine (1992, 1996): Untergattung *Davidsatax*]

Unionicola inflexa: Walter (1935)
Unionicola (Hexatax) inflexa: Lundblad (1949)

K. Viets (1921) beschrieb ♂, ♀ und Nymphe aus Ruanda. Walter (1935) nennt 1 ♂ und 2 ♀♀ aus Französisch Westafrika und Walter (1946) 1 ♂ aus Mauretanien. Lundblad (1949) bildet ♂ und ♀ aus dem Ostkongo ab und Bader (1968) nennt die Art aus Ruanda (2 ♂♂, 1 ♀) und Obervolta (heute Burkina Faso) (14 ♂♂, 19 ♀♀).

Charakteristisch für die Art ist die Krümmung des I.B.6, auf die erstmalig Walter (1935) hinwies und die Lundblad (1949) bestätigte.

Die Typusserie befindet sich in der Sammlung K. Viets im SMF. Sie besteht aus 2 ♀♀, 1 ♂ und 1 Nymphe (K. Viets-Präp. 1975–1978), die alle mit „Type" bezeichnet sind. K. Viets (1921) legte keinen Holotypus fest, beschrieb aber das ♀ zuerst und ausführlicher als das ♂ und zeichnete die Abbildungen des ♀ (Abb. 3a, 3b) ganz offenbar nach seinem Präp. 1976. Ich lege daher das ♀ im K. Viets-Präparat 1976 als Lectotypus von *Unionicola inflexa* fest. Es trägt die Beschriftung: „Ost-Afrika, Mohasi-See, Ruanda, Plankton, 1.VIII.1907, Dr. Schubotz". Die übrigen drei Syntypen werden damit zu Paralectotypen.

Die Maße der Typusexemplare sind in Tab. 11 angegeben. Erstaunlich erscheint, dass K. Viets (1921) in seiner Erstbeschreibung die charakteristische Krümmung der I.B.6 nicht erwähnt. Beim Lectotypus und teilweise auch bei den Paralectotypen sind die I.B.6 im Präparat nicht genau von der Seite zu sehen, sodass die Krümmung nicht sofort auffällt. Sie ist jedoch vorhanden. – Der Artname *inflexa* bezieht sich vermutlich auf das P.5, das K. Viets als „gekrümmt" bezeichnet, ohne dies freilich besonders hervorzuheben; er bildet jedoch die Palpe von ♀ und Nymphe ab. Tatsächlich ist das P.5 bei *U. inflexa* etwas stärker gekrümmt als sonst bei *Unionicola* üblich (Abb. 160–161). Die Krümmung des I.B.6 zeigen die Abb. 168–169.

Das I.B.5 hat kurz vor dem proximalen Ende im Bereich der Einlenkung seiner beiden kräftigen Borsten eine ebenfalls charakteristische Verdickung, auf die schon Lundblad (1949) hinweist (Abb. 168–169). Das 1. Beinpaar dient bei *Unionicola* vor allem zum Ergreifen und Festhalten von Beutetieren. Es trägt bei *U. inflexa* ausgesprochen wenige, aber kräftige Borsten, während die langen Schwimmborsten vom II.B. an in Anzahl vorhanden sind und bis zum IV.B. kontinuierlich zunehmen (Abb. 169–172).

Die I.–IV.B.6 der ♀♀ sind im Verhältnis zu den übrigen Extremitätengliedern kürzer als bei den ♂♂, eine Besonderheit, die bei anderen *Unionicola*-Arten bislang nicht beobachtet wurde. Die I.–IV.B.6 der Nymphen sind dagegen, wie bei *Unionicola* üblich, im Verhältnis zu den übrigen Extremitätengliedern länger als bei den Adulti. Die Größe der Adulti variiert in einer weiten Spanne (Tab. 11). Die Napfplatten der ♂♂ und ♀♀ besitzen eine teilweise nur unscharfe Umgrenzung, die der ♀♀ sind medial im Bereich der Insertionsstellen der insgesamt drei Paar Stechborsten kräftig aufgebogen (Abb. 167).

Idiosomagrößen: ♂♂: 442 × 340 µm bis 714 × 530 µm (n = 9), ♀♀: 397 × 384 µm bis 829 × 602 µm (n = 11), Nymphen: 344 × 220 µm bis 368 × 240 µm (n = 4).

U. inflexa gehört zu den vier häufigsten *Unionicola*-Arten im N'Zi. Es wurden 203 ♂♂, 301 ♀♀ und 4 Nymphen gefangen, die in der Tagdrift (109 ♂♂, 144 ♀♀) und

Tab. 11. *Unionicola inflexa*, Maße der Extremitätenglieder in µm. – Abkürzungen siehe Kap. 2.

Unionicola inflexa	P		I.B.				II.B.				III.B.				IV.B.				III.+ IV.Cp.		Np.
	4	5	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	L	B	L
Lectotypus, ♀, K. VIETS-Präp. 1976, Ost-Afrika	93	76	168	197	178	118	165	205	227	165	127	171	176	147	174	202	202	–	212	220	
Paralectotypus, ♀, K. VIETS-Präp. 1975, Ost-Afrika	75	66	154	159	155	91	132	165	185	142	107	138	147	120	155	169	161	122	192	200	
Paralectotypus, ♂, K. VIETS-Präp. 1977, Ost-Afrika	81	68	150	177	155	110	147	187	212	–	112	155	166	144	160	180	188	151	184	190	
Paralectotypus, Nymphe, K. VIETS-Präp. 1978, Ost-Afrika	58	49	74	85	83	72	78	90	107	99	63	81	91	83	81	90	105	91	88	99	
N'Zi, 8 ♂♂, Mittelwerte, Präp. 1031–1038	95	85	157	201	221	130	164	215	249	202	135	189	202	174	185	223	229	191	197	205	155
N'Zi, 8 ♂♂, Maxima, Präp. 1031–1038	109	100	187	237	270	148	187	248	290	225	156	218	235	203	212	254	267	217	218	225	172
N'Zi, 8 ♂♂, Minima, Präp. 1031–1038	80	68	133	160	162	110	135	173	197	158	110	151	163	135	155	176	180	142	167	184	129
N'Zi, 11 ♀♀, Mittelwerte, Präp. 1039–1046, 1051–1053	100	88	161	210	234	124	166	217	241	178	139	193	200	162	185	216	219	169	208	198	
N'Zi, 11 ♀♀, Maxima, Präp. 1039–1046, 1051–1053	110	99	180	242	276	139	184	253	278	195	156	219	228	178	202	243	250	188	230	216	
N'Zi, 11 ♀♀, Minima, Präp. 1039–1046, 1051–1053	79	70	138	175	169	109	140	183	206	145	122	160	169	130	165	190	189	140	185	152	
N'Zi, 4 Nymphen, Mittelwerte, Präp. 1048–1055	59	53	74	81	83	82	76	91	110	102	65	79	93	92	82	96	106	99	87	97	
N'Zi, 4 Nymphen, Maxima, Präp. 1048–1055	62	55	77	86	86	85	80	95	114	105	66	86	97	96	85	99	112	104	90	105	
N'Zi, 4 Nymphen, Minima, Präp. 1048–1055	55	50	68	74	79	76	68	85	105	96	65	73	91	89	78	90	98	93	85	82	

in der Nachtdrift (94 ♂♂, 157 ♀♀, 4 Nymphen) vertreten waren. Die Art kam an allen fünf Untersuchungsstationen im N'Zi vor, allerdings in sehr unterschiedlichen Fangzahlen: Tinbé: 110 ♂♂, 151 ♀♀, 4 Nymphen; Fetekro: 17 ♂♂, 39 ♀♀; Ouokoukro: 35 ♂♂, 71 ♀♀; Kolomikro: 30 ♂♂, 27 ♀♀; Bocanda: 11 ♂♂, 13 ♀♀. Zur Phänologie siehe Kap. 3.

Unionicola (Unionicola) pollicigera Viets, 1921

[VIDRINE (1992, 1996): Untergattung *Unionicola*]

K. VIETS (1921) beschrieb ♀ und ♂ nach Tieren vom 17.III.1908 aus dem Albert-See in Ostafrika. Lediglich WALTER (1935, 1937) beschrieb nachfolgend jeweils eine Nymphe aus Französisch Westafrika (heute Burkina Faso) und aus Angola, wobei die Artzugehörigkeit nicht als gesichert gelten kann. WALTER nahm z. B. keine Abgrenzung zu *U. fimbriata* vor, die als Adultus durch die Anzahl der Genitalnäpfe eindeutig von *U. pollicigera* zu unterscheiden ist, nicht jedoch als Nymphe.

Die Typusserie befindet sich in der Sammlung K. VIETS im SMF. Sie besteht aus 1 ♀ (Präp. Nr. 1980) und 1 ♂ (Präp. Nr. 1981), die beide mit „Type" bezeichnet sind. Von diesen beiden Syntypen wird das ♀ hiermit als Lectotypus festgelegt, da K. VIETS (1921) das ♀ zuerst und wesentlich ausführlicher beschrieb und dessen linke Palpe von der Innenseite abbildete (Taf. XI, Abb. 4a). K. VIETS

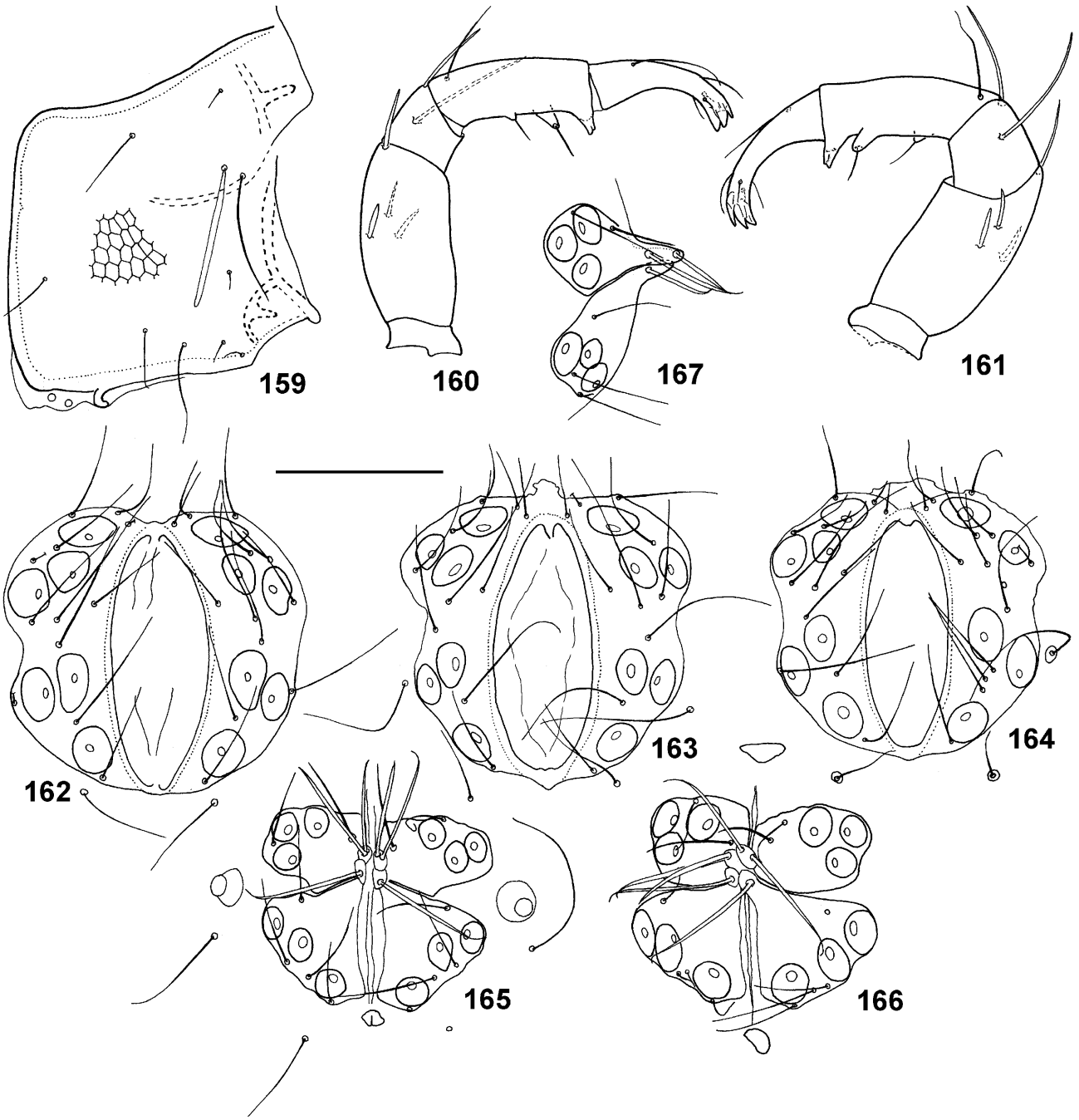

Abb. 159–167. *Unionicola inflexa*. – **159**. ♂, III.+IV.Cp., Präp. 1038. **160**. ♂, linke Palpe von innen, Präp. 1034. **161**. ♀, linke Palpe von außen, Präp. 1041. **162**. ♂, Napfplatten, Präp. 1031. **163**. ♂, Napfplatten, Präp. 1035. **164**. ♂, Napfplatten mit einem Napf vorne zu wenig, Präp. 1033. **165**. ♀, Napfplatten, Präp. 1043. **166**. ♀, Napfplatten, Präp. 1041. **167**. ♀, Napfplatten von der Seite, Präp. 1042. – Maßstrich: 100 µm.

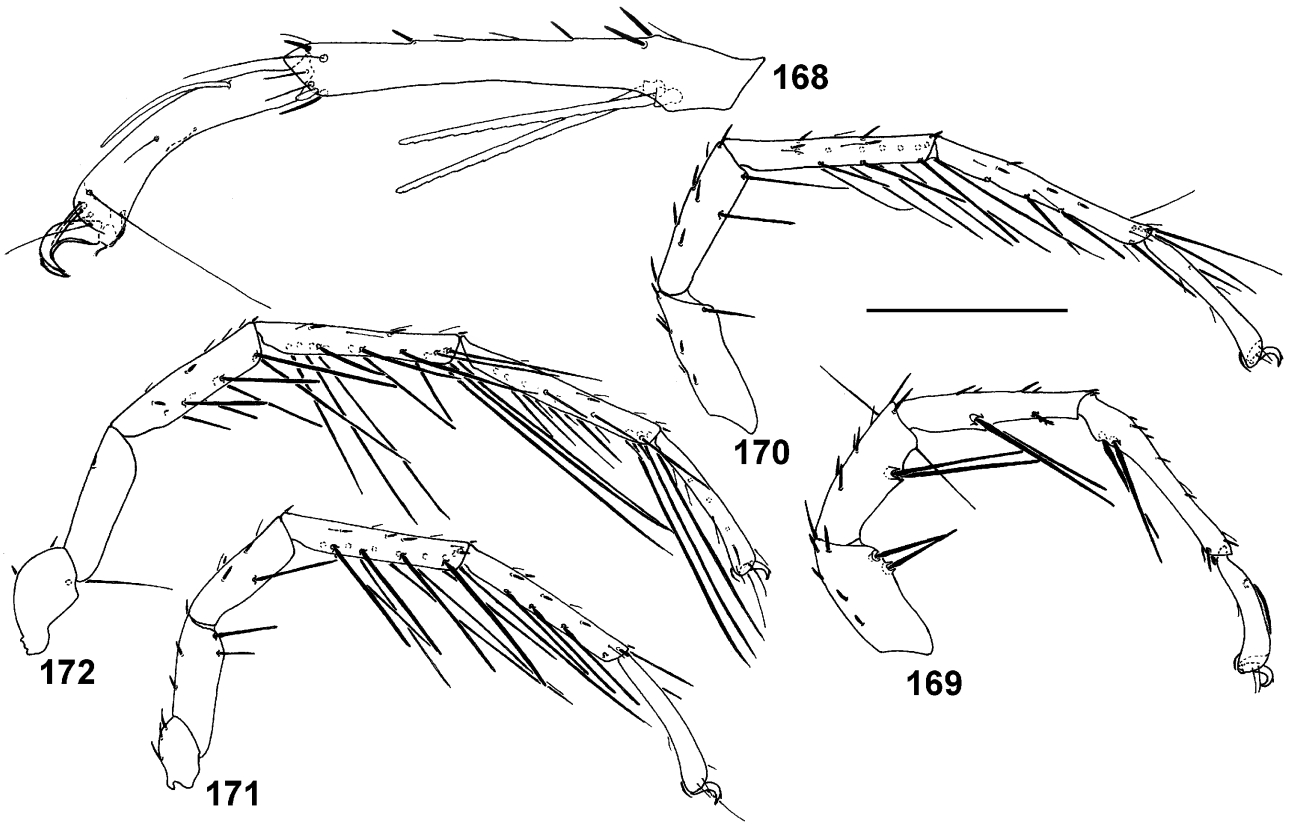

Abb. 168–172. *Unionicola inflexa*. – **168**. ♂, linkes I.B.5–6 von hinten, Präp. 1033. **169**. ♀, linkes 1. Bein von vorne, Präp. 1046. **170**. ♀, linkes 2. Bein von vorne, Präp. 1046. **171**. ♀, linkes 3. Bein von vorne, Präp. 1046. **172**. ♀, linkes 4. Bein von vorne, Präp. 1046. – Maßstrich: 100 µm (168), 200 µm (169–172).

Tab. 12. *Unionicola pollicigera*, Maße der Extremitätenglieder in µm. – Abkürzungen siehe Kap. 2.

Unionicola pollicigera	P		I.B.				II.B.				III.B.				IV.B.				III.+ IV.Cp.		Np.
	4	5	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	L	B	L
Lectotypus, ♀, K. VIETS-Präp. 1980, Albert-See	93	75	201	266	177	173	236	288	304	248	170	203	222	196	197	256	328	277	212	158	
Paralectotypus, ♂, K. VIETS-Präp. 1981, Albert-See	78	64	164	213	152	152	191	242	268	221	143	175	196	165	163	223	288	243	187	127	
N'Zi, 3 ♂♂, Mittelwerte, Präp. 1058–1059, 1111	73	65	155	202	154	157	208	256	268	222	153	174	200	176	169	215	288	249	200	139	131
N'Zi, 6 ♀♀, Mittelwerte, Präp. 1060–1065	92	77	198	253	183	179	228	274	282	242	175	195	219	199	193	234	311	286	212	152	
N'Zi, 6 ♀♀, Maxima, Präp. 1060–1065	98	80	207	260	187	186	245	287	294	259	182	204	229	208	205	240	323	302	219	155	
N'Zi, 6 ♀♀, Minima, Präp. 1060–1065	87	73	186	241	179	168	203	255	265	224	162	185	207	185	179	224	293	265	203	144	

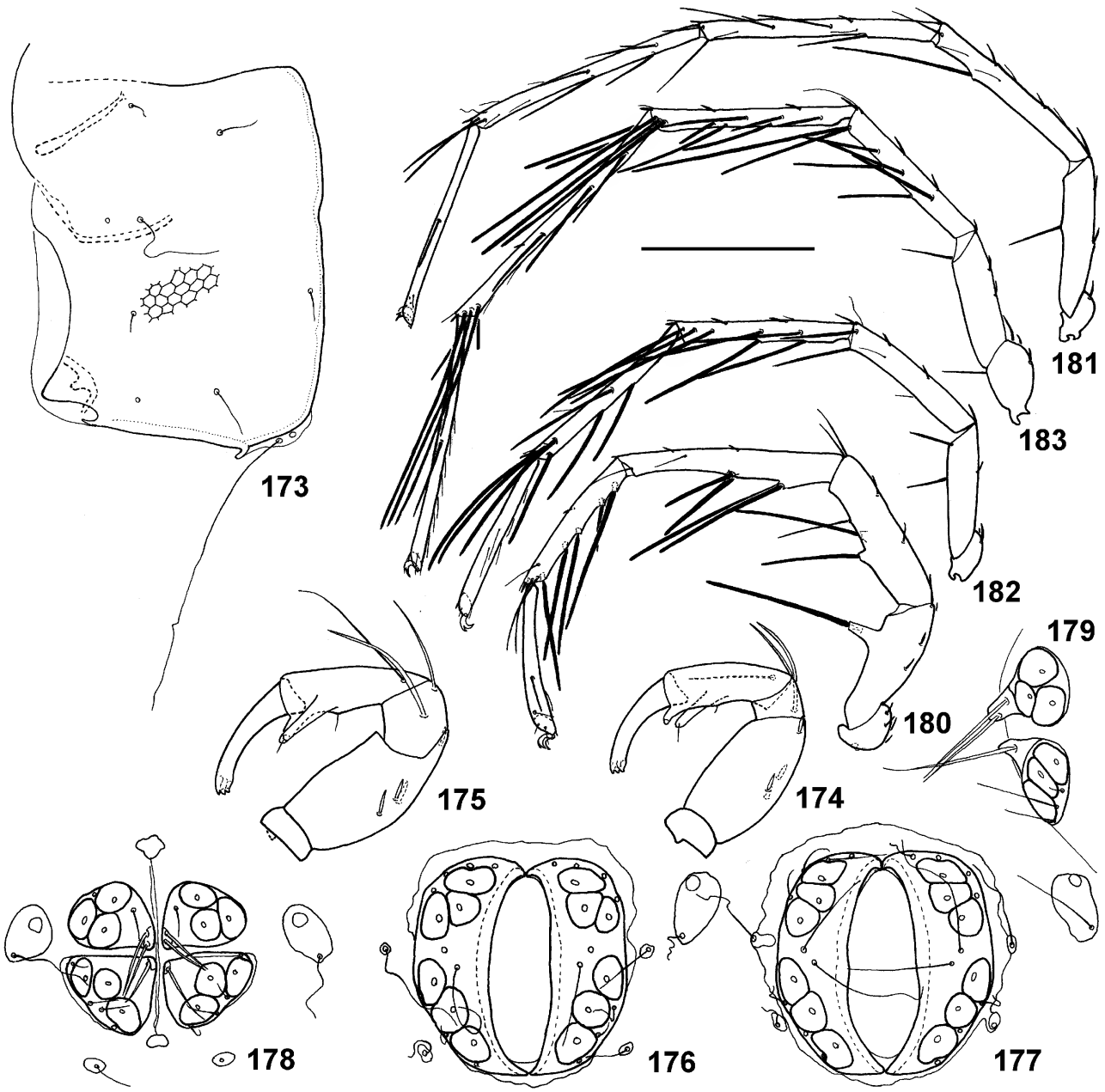

Abb. 173–183. *Unionicola pollicigera*. – **173**. ♀, III.+IV.Cp., Präp. 1060. **174**. ♂, rechte Palpe von innen, Präp. 1058. **175**. ♀, linke Palpe von außen, Präp. 1964. **176**. ♂, Napfplatten, Präp. 1058. **177**. ♂, Napfplatten, Präp. 1059. **178**. ♀, Napfplatten, Präp. 1964. **179**. ♀, Napfplatten von der Seite, Präp. 1061. **180**. ♀, linkes 1. Bein von hinten, Präp. 1060. **181**. ♀, linkes 2. Bein von hinten, Präp. 1060. **182**. ♀, linkes 3. Bein von hinten, Präp. 1060. **183**. ♀, linkes 4. Bein von hinten, Präp. 1060. – Maßstrich: 100 µm (173–179), 200 µm (180–183).

übersah bei seiner Abbildung eine kräftige, lange Borste auf der Mitte der Außenseite des P.3 und eine lange, dünne Borste proximal auf der Außenseite des P.4 (Abb. 174–175). Beide Borsten sind beim Lectotypus vorhanden, jeweils einmal als Borste und einmal als Insertionsstelle der ausgefallenen Borste. Auch beim Paralectotypus sind bzw. waren sie vorhanden.

Die Typusexemplare wurden neu vermessen und die Maße der Extremitätenglieder in Tab. 12 mit aufgeführt.

Die drei hinteren Näpfe auf den Napfplatten des ♂ liegen in Reihe, die drei vorderen Näpfe können jedoch sowohl im Dreieck als auch in Reihe liegen (Abb. 176–177). Die III.B. und besonders die IV.B. tragen kräftige Schwimmborsten, die auf den II.B. nur sehr schwach ausgebildet sind, wie schon K. VIETS (1921) bemerkte (Abb. 180–183).

Idiosomagrößen: ♂♂: 430 × 331 µm bis 485 × 415 µm (n = 3), ♀♀: 481 × 336 µm bis 630 × 534 µm (n = 6).

U. pollicigera wurde nur in wenigen Exemplaren (3 ♂♂, 6 ♀♀) im N'Zi gefangen. Sie kam nur an drei Untersuchungsstationen vor: bei Tinbé (1 ♂, 12.IX.1977, Tagdrift), Ouokoukro (1 ♀, 8.VI.1977, Nachtdrift) und Kolomikro (2 ♂♂, 7.VI.1977, Tagdrift; 1 ♀, 26.I.1977, Nachtdrift; 1 ♀, 16.II.1977, Nachtdrift; 3 ♀♀, 7.VI.1977, Tagdrift).

5 Nachbeschreibungen nahe verwandter Arten

Zur Bestimmung und Bearbeitung der Tiere aus dem N'Zi wurde auch Sammlungs- und vor allem Typenmaterial nahe verwandter Arten ausgeliehen und bearbeitet, die letztlich in den Fängen aus dem N'Zi nicht vertreten waren. Da die ursprünglichen Beschreibungen einiger dieser Arten jedoch dringend ergänzungsbedürftig für zukünftige Arbeiten sind, sollen im Folgenden Nachbeschreibungen dieser Arten gegeben werden.

5.1 Untergattung *Armatax* Bader, 1981

BADER (1981) stellte die neue Untergattung *Armatax* auf, um in ihr die nahe verwandten Arten *U. koenikei*, *U. armata*, *U. dentifera* und *U. cooki* vereinigen zu können, die zuvor auf die beiden Untergattungen *Pentatax*

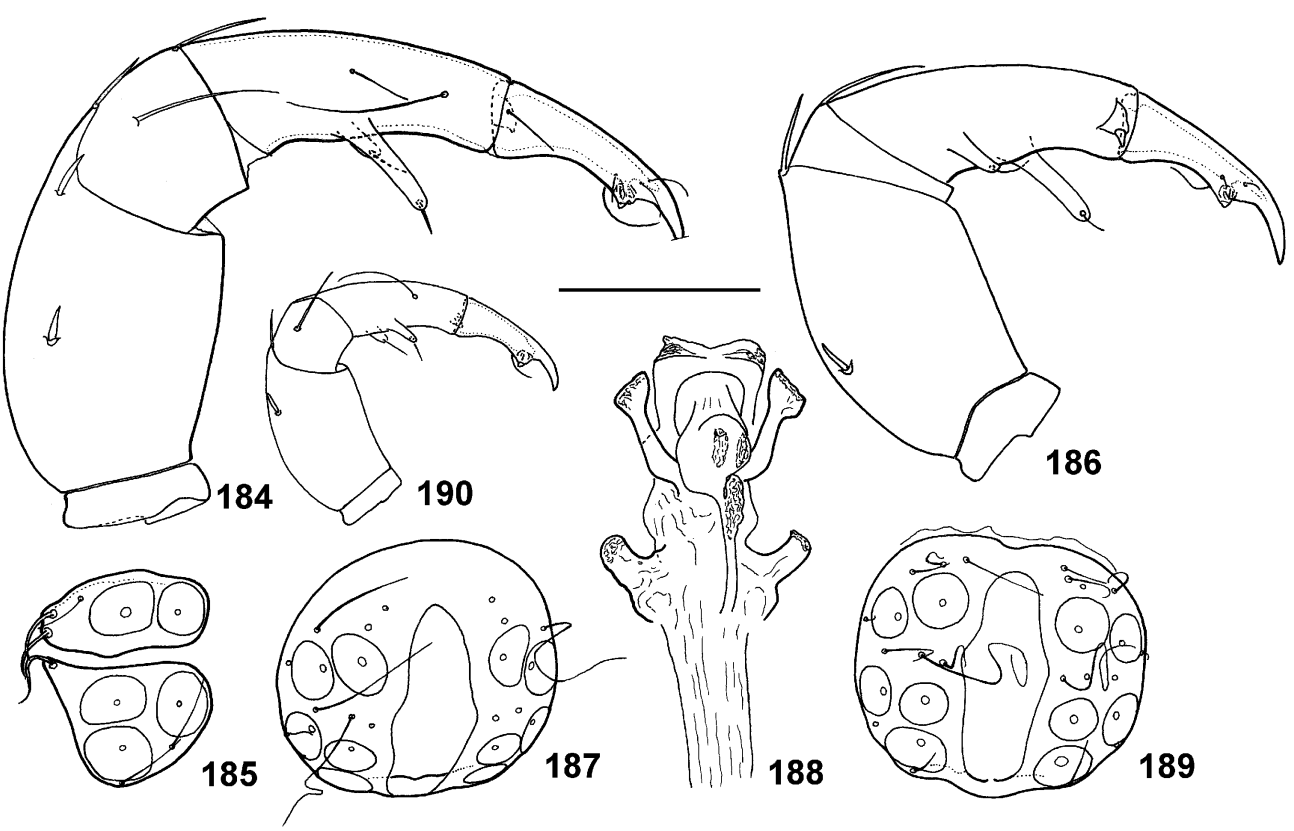

Abb. 184–190. *Unionicola koenikei*. – **184**. Lectotypus, ♀, rechte Palpe von außen, K. VIETS-Präp. 1225. **185**. Lectotypus, ♀, linke Napfplatten, K. VIETS-Präp. 1225. **186**. Paralectotypus, ♂, linke Palpe von innen, K. VIETS-Präp. 1226. **187**. Paralectotypus, ♂, Napfplatten, K. VIETS-Präp. 1226. **188**. Paralectotypus, ♂, Genitalskelett, K. VIETS-Präp. 1226. **189**. Paralectotypus, ♂, Napfplatten, K. VIETS-Präp. 1363. **190**. Paralectotypus, Nymphe, rechte Palpe von außen, K. VIETS-Präp. 1227. – Maßstrich: 100 µm.

und *Unionicola* verteilt waren, was bereits Cook (1966: 141) bedauerte. Gemeinsames Merkmal der Arten sind die „langen, fingerförmigen Chitinfortsätze" an einigen Coxalplatten (besonders den II. und III.Cp.). Bader (1981) und Vidrine (1996) übersahen, dass *U. crenipalpis* ebenfalls in diese Untergattung zu stellen ist.

Heute gehören in die Untergattung *Armatax* folgende Arten: Afrika: *Unionicola koenikei* Viets, 1913 (Kamerun, Burkina Faso, Angola, Liberia), *U. dentifera* Cook, 1966 (Liberia, Elfenbeinküste, Kamerun), *U. cooki* Bader, 1981 (Kamerun, Elfenbeinküste), *U. bicornis* n. sp. (Elfenbeinküste). –Asien: *U. armata* Walter, 1929 (Java, Sumatra, Burma, Indien), *U. crenipalpis* Lundblad, 1969 (Burma).

Unionicola (Armatax) koenikei Viets, 1913

Unionicola koenikei: Viets (1914)
Unionicola koenikei: Walter (1935)
Unionicola koenikei: Walter (1937)
Unionicola (Pentatax) koenikei: Cook (1966)

U. koenikei wurde von K. Viets (1913/14) von zwei Fundorten in Kamerun beschrieben. Die Typusserie befindet sich in der Sammlung K. Viets im SMF. Sie besteht aus fünf Tieren, von denen drei Tiere (1 ♀, Präp. 1225; 1 ♂, Präp. 1226; 1 Nymphe, Präp. 1227) mit „Type" bezeichnet sind und jeweils die Funddaten „Nyanga, Nebenfluss des Wuri b. Dibombe, 17.I.1912, Damköhler leg."

Tab. 13. *Unionicola koenikei* im Vergleich zu *U. dentifera*, Maße der Extremitätenglieder in µm. * = von Viets (1913/14) zu *U. koenikei* gezählt, besitzt aber 12 Näpfe auf den Napfplatten, daher nachträglich zu *U. dentifera* zu stellen. – Abkürzungen siehe Kap. 2.

Unionicola koenikei ***Unionicola dentifera***	P		I.B.				II.B.				III.B.				IV.B.				III.+ IV.Cp.		Np.
	4	5	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	L	B	L
Unionicola koenikei																					
Lectotypus, ♀, K. Viets-Präp. 1225, Kamerun	172	122	170	244	238	202	244	372	399	306	210	282	356	280	230	337	426	401	250	181	
Paralectotypus, ♂, K. Viets-Präp. 1226, Kamerun	154	114	136	215	221	191	221	335	359	290	186	261	322	256	206	311	380	351	230	157	131
Paralectotypus, ♂, K. Viets-Präp. 1363, Kamerun	–	–	153	240	226	191	252	385	416	314	205	290	355	286	218	335	435	380	–	162	124
Paralectotypus, Nymphe, K. Viets-Präp. 1227, Kamerun	84	63	70	117	113	108	111	163	184	154	92	131	171	145	101	162	196	188	110	81	
Unionicola dentifera																					
nach Cook (1966), Syntypus, ♀, Liberia	166	121	156	219	221	163															
nach Cook (1966), Syntypus, ♀, Liberia	171	125	169	228	222	170															
nach Cook (1966), Paratypus, ♂, Liberia	154	111	145	204	208	159															
nach Cook (1966), Paratypus, ♂, Liberia	156	117	149	211	215	162															
Viets (1913/14) *, ♀, K. Viets-Präp. 1362, Kamerun	–	–	172	250	254	182	219	319	337	298	183	250	298	259	213	303	390	375	225	180	
N'Zi, ♀, Tinbé 12.IX.1977, Präp. 1109	–	–	159	225	228	161	214	305	324	279	178	245	307	259	230	303	402	365	230	180	
N'Zi, ♀, Kolomikro 10.V.1977, Präp. 1110	149	110	150	212	208	163	210	284	311	268	172	234	290	244	214	274	370	340	228	180	

tragen und zwei Tiere (1 ♀, Präp. 1362; 1 ♂, Präp. 1363) mit „Co-Type" bezeichnet sind und jeweils die Funddaten „Manoka b. Duala, 31.XII.1911, Tümpel, DAMKÖHLER leg." tragen. Aus den fünf Syntypen wird hiermit das ♀ Präp. 1225 als Lectotypus festgelegt, da K. VIETS (1913/14) das ♀ vor dem ♂ und der Nymphe beschrieb und nur das ♀ abbildete. Die übrigen vier Tiere werden damit zu Paralectotypen. Napfplatten und Hinterende der 4. Coxalplatten des ♂ bildet K. VIETS (1914) ab.

Nur bei den drei Tieren vom locus typicus sind die Palpen abpräpariert und daher zu untersuchen. Bei ihnen sind die Beugeseitenzapfen am P.4 außerordentlich lang (der laterale bis 55 µm), und der Beugeseitenzapfen am P.5 liegt nicht in der Gliedmitte, sondern mehr zum Distalende hin – auch bereits bei der Nymphe (Abb. 184, 186, 190).

Die Napfplatten des ♀ von Manoka (Präp. 1362) tragen 12 Näpfe, die keine Anzeichen einer Missbildung zeigen (Abb. 29). Erstaunlicherweise erwähnt K. VIETS (1913/14) dies nicht. Das ♀ muss nachträglich zu *U. (Armatax) dentifera* Cook, 1966 gestellt werden. Auch WALTER (1935: 104) stellte bei einem seiner beiden *U. koenikei*-♀♀ 12 Näpfe fest, die er jedoch nur für eine individuelle Abweichung hielt.

Die fünf Typusexemplare wurden neu vermessen und die Maße der Extremitätenglieder im Vergleich zu *U. dentifera* in Tab. 13 angegeben. COOK (1966) betont eine große Variabilität von *U. koenikei* bei dem ihm vorliegenden umfangreichen Material aus Liberia (63 ♂♂, 240 ♀♀) in der Länge der Extremitätenglieder und der Länge der Beugeseitenzapfen des P.4.

5.2 *Unionicola (Pentatax) borgerti*-Gruppe – Revision der afrikanischen Arten

Innerhalb der Untergattung *Pentatax* lässt sich eine *Unionicola borgerti*-Gruppe abgrenzen [nach VIDRINE 1996 in Untergattung *Unionicola*; vgl. Kap. 4]. Sie ist gekennzeichnet durch eigentümlich verbreiterte, auffallend große, aber stumpfe Krallen am 1. Beinpaar und durch das letzte Palpen-Glied, das in eine stumpfe Spitze zuläuft und keinerlei Zähne an seinem Ende aufweist.

Aus dieser Gruppe wurden bislang aus Afrika beschrieben: *Unionicola borgerti* (Daday, 1907), *U. vietsi* Walter, 1935 [= *U. borgerti* sensu VIETS (1913)], *U. lineata* Viets, 1925, *U. megalopsis* Viets, 1925, *U. chappuisi* Walter, 1935, *U. dadayi* Cook, 1966 und *U. nziensis* n. sp.

Da die Artabgrenzungen wegen unzulänglicher Diagnosen bislang weitgehend unklar sind, ist eine Revision dieser Gruppe dringend erforderlich. Dazu wurden die noch vorhandenen Präparate und unpräparierten Tiere von DADAY, K. VIETS, WALTER und BADER herangezogen und das umfangreiche neue Material aus der Elfenbeinküste verwendet.

U. megalopsis und *U. nziensis*, die im N'Zi der Elfenbeinküste vorkommen, werden in Kap. 4 beschrieben. Hier nicht berücksichtigt werden die südostasiatischen Tiere der *U. borgerti*-Gruppe: *U. similis* Viets, 1935 (siehe VIETS 1935) und die Tiere, die LUNDBLAD (1969) zu *U. chappuisi* stellt, ohne sie neu zu beschreiben.

Die *Unionicola borgerti*-Gruppe ist innerhalb der Untergattung *Pentatax* gut abgrenzbar, ihre Arten jedoch lassen sich teilweise nur schwer unterscheiden. Das liegt einerseits an unzureichenden Beschreibungen und Differentialdiagnosen, aber andererseits auch an dem nur wenig erhaltenen Material. Gut unterscheiden lassen sich bei den afrikanischen Arten *U. vietsi*, *U. megalospis* und *U. nziensis*, was sich auch bereits deutlich im Proportionalitätsdiagramm dieser drei Arten zeigt (Abb. 209). Für *U. borgerti* und *U. lineata* ist das vorliegende Material zu gering für eine eindeutige Beurteilung, und für *U. chappuisi* ist die Artberechtigung fraglich. *U. dadayi* ist dagegen aufgrund der relativ langen I.B.4 und I.B.5 sicherlich eine eigenständige Art, deren Beschreibung und Differentialdiagnose jedoch ergänzungsbedürftig sind.

Unionicola (Pentatax) borgerti (Daday, 1907)

Die Art wurde nach einem ♀ aus dem Victoriasee bei Entebbe im heutigen Uganda unzulänglich beschrieben (DADAY 1907, 1910).

Das Holotypus-Präparat von *U. borgerti* hat sich überraschenderweise im NHMB erhalten. Das Präparat trägt die Beschriftung „*Atax Borgerti* Dad., Victoria Nyanza, 1904". Es ist in einem schlechten Zustand. Lediglich ein strukturloses Körperteil und das Gnathosoma mit dem rechten Palpus und den ersten beiden Gliedern des linken Palpus sind erhalten. Das Gnathosoma selbst ist weitgehend zersetzt, sodass nur der Palpus zu Klärungen herangezogen werden kann (Abb. 191). Die Borsten sind bis auf eine am linken P.2 nicht erhalten und auch die Insertionsstellen sind nicht mehr festzustellen.

DADAY hatte offenbar keine geeignete Messmöglichkeit, sodass seine angegebenen Maße ungenau und zu groß sind. Das P.4 misst 62 µm und das P.5 57 µm (nicht jeweils 0,08 cm).

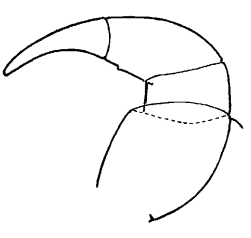

Abb. 191. *Unionicola borgerti*, Holotypus, ♀, rechte Palpe von innen, DADAY-Präp. – Maßstrich: 100 µm.

Unionicola (Pentatax) vietsi Walter, 1935

Unionicola borgerti: Viets (1913) (Fehlbestimmung)

Die Tiere, die K. Viets (1913/14) fälschlicherweise der Art *U. borgerti* zugeordnet und als solche mit ihren Merkmalen beschrieben hat, wurden von Walter (1935) mit Recht als eine eigenständige neue Art aufgefasst und von ihm benannt als *U. vietsi*. So unzureichend auch die Beschreibungen und Abbildungen von Daday (1907, 1910) sind, so kann doch bereits aus der auffälligen Langborste am P.3 und der keinen rechten Winkel bildenden medialen caudalen Ecke der IV.Cp. bei *U. vietsi* auf einen Artunterschied zu *U. borgerti* geschlossen werden.

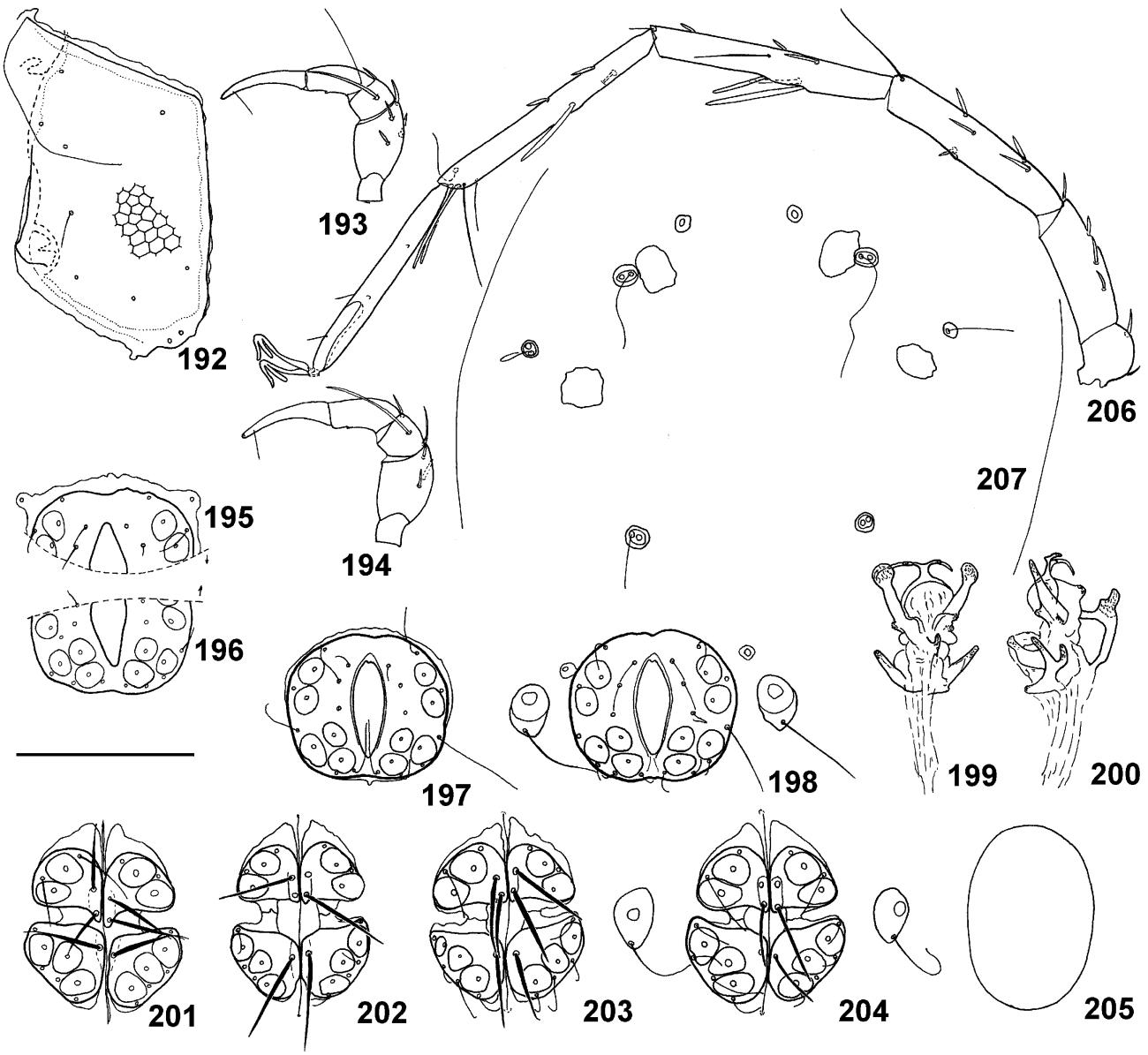

Abb. 192–207. *Unionicola vietsi*. – **192**. ♂, III.+IV.Cp., Präp. 908. **193**. ♂, linke Palpe von außen, Präp. 907. **194**. Lectotypus, ♀, linke Palpe von außen, K. Viets-Präp. 1277. **195**. Paralectotypus, ♂, Napfplatten (an gestrichelter Linie weggebogen), K. Viets-Präp. 1366. **196**. Paralectotypus, ♂, Napfplatten (an gestrichelter Linie weggebogen), K. Viets-Präp. 1366. **197**. ♂, Napfplatten, Präp. 909. **198**. ♂, Napfplatten, Präp. 907. **199**. ♂, Genitalskelett ventral, Präp. 907. **200**. ♂, Genitalskelett lateral, Präp. 909. **201**. Paralectotypus, ♀, Napfplatten, K. Viets-Präp. 1339. **202**. ♀, Napfplatten, Präp. 915. **203**. ♀, Napfplatten, Präp. 919. **204**. ♀, Napfplatten, Präp. 920. **205**. Ei, Präp. 920. **206**. ♀, rechtes 1. Bein von vorne mit den charakteristischen verbreiterten, stumpfen Krallen, Präp. 913. **207**. ♀, dorsale chitinisierte Flecken und Insertionsstellen von Borsten, Präp. 915. – Maßstrich: 100 µm.

K. VIETS lagen für seine Beschreibung von „*borgerti* Daday" eine nicht genannte Zahl von ♂♂, ♀♀ und Nymphen von drei verschiedenen Fangtagen aus einem temporären „Regenwasserbach" auf der Halbinsel Manóka (Kamerun) südlich von Duala (Douala) vor. Davon sind in der Sammlung K. VIETS im SMF vier Präparate vorhanden: zwei Präparate mit jeweils einem ♀ (K. VIETS-Präp. 1277 und 1339), ein Präparat mit 2 ♂♂ (K. VIETS-Präp. 1366) und ein Präparat mit einer Nymphe (K. VIETS-Präp. 1367). Die Präparate 1366 und 1367 sind mit „Type" bezeichnet, was jedoch ohne Bedeutung ist, da K. VIETS keine neue Art beschrieben hat. Alle fünf Tiere in den vier Präparaten sind heute Syntypen von *U. vietsi* Walter.

In K. VIETS-Präp. 1277 ist ein teilzergliedertes ♀ fast komplett enthalten, nach dem K. VIETS (1913/14: Abb. 14d) die Palpe abgebildet hat (siehe Abb. 194). Im K. VIETS-Präp. 1339 sind dagegen von einem ♀ lediglich drei einzelne Beine (ein I.B. und zwei II.B.), die Napfplatten und Rudimente von Coxalplatten, Gnathosoma und Cheliceren enthalten; hiernach bildete K. VIETS (1913/14: Abb. 14c) die Napfplatten ab (siehe Abb. 201). Der größeren Vollständigkeit wegen lege ich hiermit das ♀ im K. VIETS-Präp. 1277 als Lectopypus von *Unionicola vietsi* Walter fest. Die Funddaten lauten: „Kamerun, Manoka b. Duala, 11.XI.1911, DAMKÖHLER leg." Die übrigen vier Syntypen werden damit zu Paralectotypen.

Fundort und Sammler sind bei allen vier Präparaten der Typusserie gleich, lediglich das Funddatum ist unterschiedlich: 23.XII.1911 für Präp. 1339 und 31.XII.1911 für Präp. 1366 und 1367. Die Tiere scheinen teilweise erst nach der Beschreibung bzw. Anfertigung der Abbildungen eingebettet worden zu sein; sie sind unzureichend präpariert.

Neben diesen Präparaten hat K. VIETS noch unpräpariertes Material der Art aufbewahrt, dessen Etikett im Sammlungsröhrchen die Funddaten: „Kamerun, Manoka, 31.XII.1911" trägt. Diese Tiere stammen also vom locus typicus und sind mit den Syntypen zusammen gesammelt worden. Aus diesem Material seines Vaters hat K. O. VIETS später ein ♂ und ein ♀ präpariert, die dann als Präp. 7749 (♂) und 7748 (♀) mit seiner Sammlung im SMF hinterlegt worden sind. Die Extremitäten der beiden Tiere sind jedoch vielfach gebrochen.

Das Sammlungsröhrchen mit den restlichen Tieren hat mir K. O. VIETS zur Verfügung gestellt. Ich habe die 5 ♂♂ und 12 ♀♀ präpariert (Präp. 907–923), sodass neue Zeichnungen angefertigt werden konnten. Bei 3 ♂♂ und 9 ♀♀ waren die Extremitäten noch so vollständig vorhanden, dass genaue Maße zu nehmen waren (Tab. 14). Die Idiosomagrößen liegen bei den ♂♂ zwischen 346 × 280 µm und 423 × 331 µm und bei den ♀♀ zwischen 405 × 362 µm bzw. 422 × 343 µm und 546 × 405 µm. Die Eier sind durchschnittlich 100 × 70 µm groß.

Tab. 14. *Unionicola vietsi*, Maße der Extremitätenglieder in µm. – Abkürzungen siehe Kap. 2.

Unionicola vietsi	P		I.B.				II.B.				III.B.				IV.B.				III.+ IV.Cp.		Np.
	4	5	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	L	B	L
Lectotypus, ♀, K. VIETS-Präp. 1277, Kamerun	41	53	127	146	157	130	116	139	156	138	110	129	165	140	115	133	175	165	157	119	
Paralectotypus, ♀, K. VIETS-Präp. 1339, Kamerun	–	–	126	148	155	129	115	146	162	141	–	–	–	–	–	–	–	–	–	–	
Paralectotypus, ♂, K. VIETS-Präp. 1366 [Abb. 195], Kamerun	35	45	108	130	138	129	102	127	140	–	95	115	147	128	104	121	158	150	135	105	–
Paralectotypus, ♂, K. VIETS-Präp. 1366 [Abb. 196], Kamerun	–	–	110	131	140	127	97	118	150	125	100	125	140	132	107	115	148	148	145	105	–
3 ♂♂, Mittelwerte, Kamerun, Präp. 907–909	39	50	113	134	140	124	104	125	142	128	100	119	148	127	104	121	161	154	143	108	83
9 ♀♀, Mittelwerte, Kamerun, Präp. 912–920	41	51	123	143	148	131	108	138	153	131	107	131	162	136	112	131	175	165	149	119	
9 ♀♀, Maxima, Kamerun, Präp. 912–920	43	54	130	147	154	137	114	145	162	140	114	135	173	143	118	140	182	175	152	130	
9 ♀♀, Minima, Kamerun, Präp. 912–920	38	47	115	138	142	125	98	132	147	126	100	125	155	126	106	124	165	155	140	110	

Unionicola (Pentatax) lineata Viets, 1925

Unionicola borgerti lineata Viets, 1925

Unionicola lineata wurde von K. Viets nach einem ♂ aus Kamerun als *Unionicola borgerti lineata* beschrieben. Der der Beschreibung zugrunde liegende Holotypus ist in der Sammlung K. Viets im SMF erhalten (Präp. 3197). Das Präparat ist mit „Type" bezeichnet und trägt die Funddaten: „Kamerun, Fluß Múke, 15.I.1916". Es ist unzureichend präpariert, die Pedipalpen liegen ausgesprochen ungünstig, sodass die von K. Viets angegebenen Besonderheiten nicht erkennbar sind, und die Napfplatten sind diagonal durchtrennt. Immerhin ist zu erkennen, dass die hinteren Näpfe, wie von K. Viets (1925) beschrieben, längs des Napfplattenrandes liegen, sehr klein sind (Durchmesser 7–10 µm) und sich nicht berühren (Abb. 208).

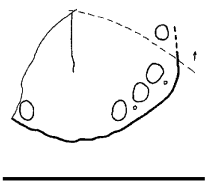

Abb. 208. *Unionicola lineata*, Holotypus, ♂, Napfplatten, an der dünnen Linie im Präparat abgeschnitten, an der gestrichelten Linie im Präparat nach unten weggebogen, K. Viets-Präp. 3197. – Maßstrich: 100 µm.

Es war nur möglich vom Holotypus-Präparat die Zeichnung eines Teils der Napfplatten anzufertigen (Abb. 208) und die in Tab. 15 mit abgedruckten fünf Maße der Extremitätenglieder zu nehmen. Diese wenigen Maße reichen jedoch nicht aus, um eine aussagefähige Proportionalitätskurve zu erstellen. K. Viets (1925) selbst bildet die Palpe ab und gibt deren Maße an.

Der Status von *U. lineata* kann damit derzeit nicht sicher beurteilt werden. Sie als Unterart bei *U. borgerti* zu belassen, erscheint nicht angebracht, da K. Viets (1925) sie als Unterart seiner inzwischen als eigene Art *U. vietsi* von *U. borgerti* abgetrennten Art gesehen hatte. Da das von K. Viets beschriebene breite Distalende des P.4 und die kleinen Genitalnäpfe längs des Hinterrandes der Napfplatten

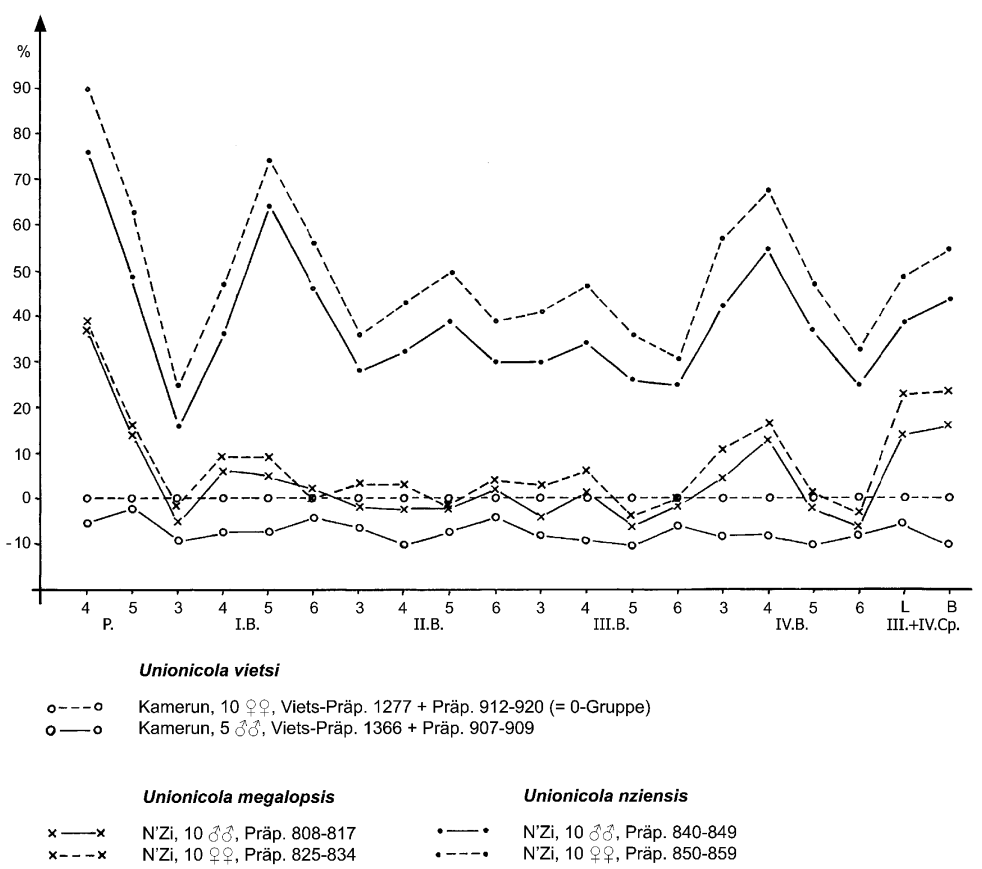

Abb. 209. Proportionalitätsdiagramm von Arten der *Unionicola borgerti*-Gruppe: *U. megalopsis* und *U. nziensis* aus dem N'Zi im Vergleich zu *U. vietsi* aus Kamerun.

(Abb. 208) in keiner Weise in die bis jetzt bekannte Variationsbreite von *U. vietsi* passen, sollte sie als eigenständige Art *Unionicola lineata* Viets, 1925 geführt werden.

Unionicola (Pentatax) chappuisi Walter, 1935

Unionicola chappuisi: Walter (1937) (Angola)
Unionicola chappuisi: Bader (1968) (Ruanda)
Unionicola chappuisi: Bader (1981) (Kamerun)

Walter (1935) beschrieb *U. chappuisi* nach einem ♀ aus Französisch-Westafrika (heute Burkina Faso), indem er sie mit *U. borgerti* und *U. vietsi* verglich, eigenartigerweise jedoch nicht mit *U. megalopsis*, obgleich er deren Erstbeschreibung (K. Viets 1925) im Literaturverzeichnis nennt. Walter (1937) stellte 1 ♂ und 1 ♀ aus Angola zu *U. chappuisi*, die er nun als zu *U. megalopsis* sehr nahe stehend erkannte. Den Hauptunterschied sah er in den männlichen Napfplatten, die er hier erstmalig für *U. chappuisi* abbildete.

Bader (1968) stellte 1 ♀ aus Ruanda zu *U. chappuisi*, ohne es mit *U. megalopsis* zu vergleichen; die Abbildungen und die Palpenmaße geben keine Unterscheidungshinweise. Schließlich stellte Bader (1981) 6 ♂♂ und 3 ♀♀ aus Kamerun ohne Vergleich mit anderen Arten zu *U. chappuisi* und gab Abbildungen und Maße. Die abgebildeten männlichen Napfplatten unterscheiden sich deutlich von den bei Walter (1937) abgebildeten, ohne dass dies kommentiert wurde.

Erhalten haben sich im NHMB von Walter das Holotypus-Präparat von *U. chappuisi* (Präp. XXVI/39) und das Präparat des *U. chappuisi*-♂ aus Angola (Präp. XXVI/77), die jedoch beide das Gnathosoma nicht enthalten! Von Bader liegen vier Präparate (3 ♂♂, 1 ♀) von *U. chappuisi* aus Kamerun vor. Die Milben aller sechs Präparate sind aufgehellt, aber unzergliedert eingebettet. Sie wurden, soweit möglich, neu vermessen (Tab. 15). Die von Bader (1981) angegebenen Maße weichen teilweise erheblich von denen seiner erhaltenen Präparate ab. Es bleibt unklar, wie viele und welche seiner neun Tiere er vermessen hat.

U. chappuisi steht *U. megalopsis* ausgesprochen nahe. Insbesondere die abgebildeten Napfplatten sind in der Variationsbreite derjenigen von *U. megalopsis* enthalten (siehe Kap. 4). Die Verhältnisse der Extremitätenglieder zueinander zeigen keine signifikanten Unterschiede zu denen von *U. megalopsis* (vgl. auch Abb. 88 und 209). Lediglich die Länge der III.+IV.Cp. ist im Verhältnis zu ihrer Breite und der Länge der Extremitätenglieder deutlich geringer.

Tab. 15. *Unionicola chappuisi* und zum Vergleich *U. borgerti* und *U. lineata*, Maße der Extremitätenglieder in µm. – Abkürzungen siehe Kap. 2.

Unionicola chappuisi	P		I.B.				II.B.				III.B.				IV.B.				III.+ IV.Cp.	
	4	5	3	4	5	6	3	4	5	6	3	4	5	6	3	4	5	6	L	B
Holotypus, ♀, Walter-Präp. XXVI/39, Burkina Faso	–	–	124	148	150	127	109	137	142	125	104	129	151	129	118	145	168	152	133	125
Holotypus, ♀, Maße aus Walter (1935)	60	60				140														
♂, Walter-Präp. XXVI/77, Angola	–	–	108	138	147	123	102	127	133	123	100	122	136	125	113	132	157	142	146	127
3 ♂♂, Mittelwerte, Bader-Präp., Kamerun	45	54	112	128	140	125	97	115	132	129	91	119	138	136	–	132	163	147	130	117
♀, Bader-Präp., Kamerun	58	60	137	162	164	140	126	153	167	–	122	147	172	155	135	164	–	–	150	142
U. borgerti, Holotypus, ♀, Daday-Präp.	62	57	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
U. lineata, Holotypus, ♂, K. Viets-Präp. 3197, Kamerun	–	–	–	–	–	–	87	–	–	–	–	–	–	–	85	120	–	–	109	83
U. lineata, Holotypus, ♂, Maße aus K. Viets (1925)	35	50																		

Nach den erhaltenen Tieren und den Beschreibungen ist derzeit eine Differenzialdiagnose, die eine Abgrenzung von *U. megalopsis* erlaubt, nicht möglich. Bis umfangreicheres, neues Material vorliegt, muss die Artberechtigung von *U. chappuisi* fraglich bleiben.

Unionicola (Pentatax) dadayi Cook, 1966

Die Art wurde nach einem ♀ aus Liberia beschrieben. Die I.B.5 und I.B.6 sind nach den angegebenen Maßen im Verhältnis zu den I.B.3, I.B.4 und den P.4 und P.5 sehr viel länger als bei *U. vietsi*. *U. dadayi* ist daher sicherlich eine eigenständige Art.

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Accessory gills in mayflies (Ephemeroptera)

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Abstract

Thread-like or finger-like accessory gills have been found on the maxillae, labia, coxae, and ventral thoracic surfaces of various lineages of mayflies (Ephemeroptera). Representative members of the seven families known to have accessory gills were examined and compared. From the regular distribution of accessory gills, usually associated with coxal segments, a hypothesis concerning their origin is postulated. The fact that these are found only in some members of the more plesiomorphic families would imply that the ability to develop a coxal gill has been retained and is displayed in some extant taxa of some ancient lineages. The possible functions of accessory gills include respiration and filtration.

Keywords: Ephemeroptera, accessory gill, origin, function.

Zusammenfassung

Bei Eintagsfliegen verschiedener Abstammungslinien lassen sich an Maxillen, Labium, Hüften und der Ventralseite des Thorax faden- oder fingerförmige akzessorische Kiemen feststellen. Charakteristische Vertreter der sieben Familien, bei denen derartige akzessorische Kiemen bekannt geworden sind, werden vergleichend untersucht. Ausgehend von der Verbreitung dieser akzessorischen Kiemen, die normalerweise mit coxalen Segmenten assoziiert sind, wird eine Hypothese zu ihrem Ursprung aufgestellt. Da Coxal-Kiemen nur bei Vertretern ursprünglicher Familien gefunden werden, liegt die Vermutung nahe, dass die Fähigkeit zur Bildung solcher Kiemen in einigen rezenten Taxa alter Entwicklungslinien erhalten geblieben ist. Mögliche Funktionen von akzessorischen Kiemen sind Atmung und Filtrierung.

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1 Introduction

Mayflies (Ephemeroptera) are aquatic insects with immature stages living in freshwater habitats. Consequently, they are morphologically adapted to the aquatic environment, and their gill adaptations (shape, number, structure and position) can be used for classification and identification (Needham et al. 1935, Edmunds et al. 1963, Peters & Campbell 1991). Kukalová-Peck (1978), based on fossil evidence, suggested that the mayfly imaginal wings are homologous with the larval abdominal gill plates, a conclusion supported by Kluge (1989), based on morphology and comparison of living species.

The gills of mayflies can be divided into two kinds: the plate-like abdominal gills (or tergaliae of Kluge et al. 1995) and the accessory gills (located on head or/and thorax) (Štys & Soldán 1980). The abdominal gills have been studied in detail, and a variety of functions have been documented: respiration (Morgan & Grierson 1932, Beaver 1990, Eriksen & Maeur 1990); osmoregulation (Wichard 1979; Wichard et al. 1972, 2002); locomotion (swimming, Kluge et al. 1984); water circulation (driving currents over the tracheated surfaces, Eastham 1932, Notestine 1994); protection (gill cover in Caenidae and Neoephemeridae, Notestine 1994); maintaining the position of the body (such as the adhesive disc of some species of *Rhithrogena* and *Epeorus*, Wichard et al. 2002, Zhou et al. 2003, Ditsche-Kuru & Koop 2009).

In addition to the functional abdominal gills, accessory gills have been found in several families (Needham et al. 1935, Štys & Soldán 1980, Müller-Liebenau 1985, Peters & Campbell 1991, Wuillot & Gillies 1994, Zhou & Peters 2003). Their origin and function are less clearly understood. Seven families are known to have accessory gills (Baetidae, Coloburiscidae, Isonychiidae, Nesameletidae, Oligoneuriidae, Rallidentidae, and Siphluriscidae). Štys & Soldán (1980) stated that because most of those taxa belong to the most ancestral evolutionary line of the order, this seemed to suggest that their presence is a plesiomorphic character; on the other hand, common sense and a comparison with other insect orders suggest that accessory gills have evolved as secondary structures supporting the function of abdominal gills. The origin of accessory gills is unclear. In this paper, I examine some typical representatives of mayflies with accessory gills and suggest a hypothesis concerning their origin and discuss their function.

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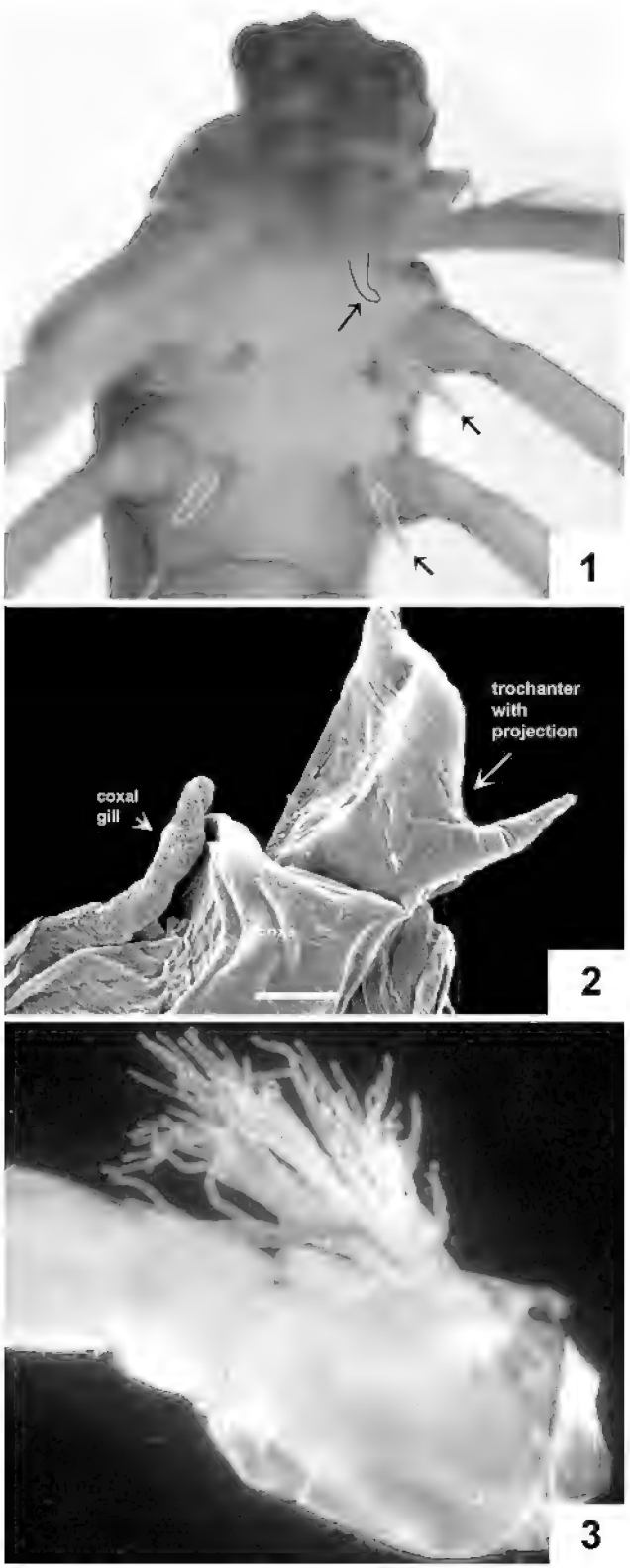
2 Results

The results of a comparative examination of accessory gills are given in Tab. 1 and more detailed pictures are provided by Staniczek (2010) in this issue. A few species need further comment. In the original description of the species later named *Afrobaetodes berneri* by Demoulin (1970), Kimmins (1955) reported that the nymphs had maxillary and sternal gills. After examining one type specimen and two nymphs collected in Guinea in 1994, the gills are located actually between the sternal sclerite and the coxae, and could be interpreted as having a coxal origin (Fig. 7).

In previous literature (like Štys & Soldán 1980), *Murphyella needhami* Lestage was reported to have gills on maxillae, labium, and forecoxae, with a single sternal gill located at the middle of each thoracic sternum. Here we can see that in *Murphyella*, accessory gills of the mouthparts are located in positions similar to those of *Siphluriscus chinensis* Ulmer (Zhou & Peters 2003), and those of the forecoxae are similar in position to those of *Baetiella bispinosa* (Gose) (Figs. 1–2, 4) and *Isonychia georgiae* McDunnough (Fig. 10). A common origin for the forecoxal

Tab. 1. Position of accessory gills in species examined.

Family: Species	Specimens examined from	Accessory gills associated with coxae or thoracic sterna	Accessory gills associated with mouthparts
Baetidae: *Baetiella bispinosa* (Gose, 1980)	China, Japan	At base of coxae in membrane between coxae and sterna on all legs (Figs. 1–2, 4)	No
Baetidae: *Baetodes huaico* Nieto, 2003	Argentina	Double gill (common base) at apex of coxae in membrane between coxae and trochanters (Fig. 5)	No
Baetidae: *Dicentroptilum papillosum* Wuillot, 1994	Mali	Double gill (apparently with common base) at base of coxae in membrane between coxae and sterna (Fig. 6)	No
Baetidae: *Heterocloeon petersi* (Müller-Liebenau, 1974)	USA (Georgia)	Single gill only on forecoxae in membrane between coxae and sterna	No
Baetidae: *Afrobaetodes berneri* Demoulin, 1970	Guinea	Single gill on each side of prosternum in membrane between coxae and sterna (Fig. 7)	Single gill at apex of basal segment of maxillary palp (Fig. 8)
Siphluriscidae: *Siphluriscus chinensis* Ulmer, 1920	China (Zhejiang)	Gill tufts at base of forecoxae and mesothoracic coxae in membrane between coxae and sterna (Figs. 3, 9)	One gill tuft near inner base of stipes on maxilla and a smaller gill tuft between stipes and cardo; gill tufts laterally on mentum of labial postmentum
Nesameletidae: *Nesameletus ornatus* (Eaton, 1883)	New Zealand	No	Single short gill laterally between stipes and cardo (maxilla)
Rallidentidae: *Rallidens macfarlanei* Penniket, 1956	New Zealand	No	Single short gill laterally between stipes and cardo (maxilla)
Isonychiidae: *Isonychia sayi* Burks, 1953	USA (Florida)	Gill tuft at base of forecoxae in membrane between forecoxae and prosternum	Gill tuft at medial base of stipes in membrane between stipes and cardo (maxilla)
Isonychiidae: *Isonychia georgiae* McDunnough, 1931	USA (Georgia)	Single gill at base of forecoxae in membrane between forecoxae and prosternum (Fig. 10)	Gill tuft at medial base of stipes in membrane between stipes and cardo (maxilla)
Coloburiscidae: *Coloburiscoides* sp.	Australia (Victoria)	No	Single long gill at base of stipes in membrane between stipes and cardo (maxilla); shorter finger-like gill on each side near apex of postmentum (labium)
Coloburiscidae: *Murphyella needhami* Lestage, 1931	Chile	Single gill in membrane between procoxae and prosternum; single median gill on each segment of thoracic sterna, median gill on prosternum in membranous area anterior to small, prosternal sclerite (Fig. 11)	Large double gill at base of stipes in membrane between stipes and cardo (maxilla); single gill on each side near apex of postmentum (labium)
Oligoneuriidae: *Lachlania dominguezi* Pereira, 1989	Argentina	No	Large gill tuft in membrane ventrally between stipes and cardo (maxilla)



Figs. 1–3. Forebody in ventral view (1) and foreleg bases (2–3). – **1–2**. *Baetiella bispinosa*. **3**. *Siphluriscus chinensis*. – 1, 3 = digital photos, 2 = SEM; the arrows in Fig. 1 indicate the gills: scale (of Fig. 2): 50 μm.

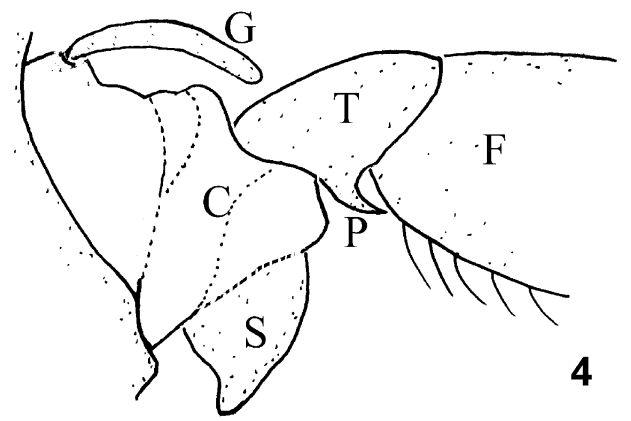
gills of *Isonychia* and *Murphyella* is supported by the common position of the tracheae (Landa 1969). However, the gills on the sterna of *Murphyella* seem to be a unique derivation, with unique tracheation (Landa 1969) although the tracheae supplying the sternal gills of *Murphyella* do come from tracheal branches with the same stem as the coxal gills. The thoracic prosternum of *Murphyella needhami* is very small in contrast to the procoxae and the membranous bases of the procoxae are enlarged, so there is a large membranous area between the coxae and the sternum. The gills of the procoxae are located near the coxal bases (Fig. 11), and other gills are located medially on each thoracic sternum.

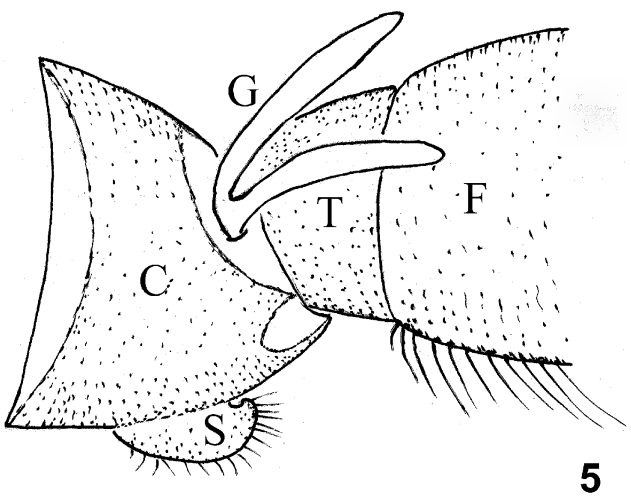
3 Conclusions and Discussion

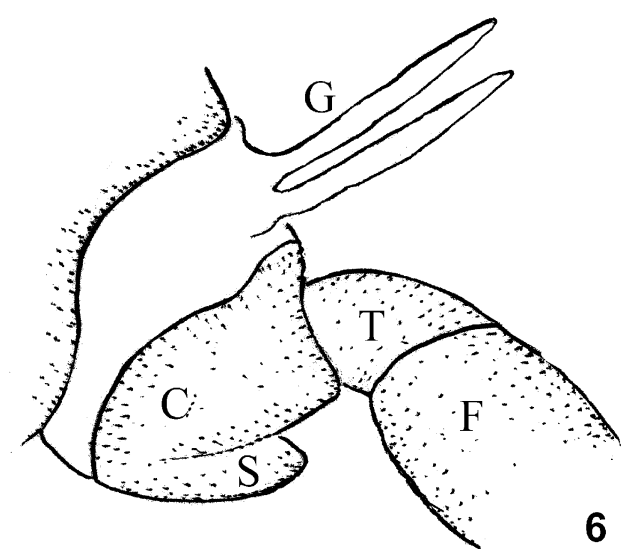
Demoulin (1969) suggested that maxillary gills are synapomorphic characters of Rallidentidae + Isonychiidae/Coloburiscidae/Oligoneuriidae (as *Chromarcys*), the latter three families representing the Eusetisura of Kluge (1998); Demoulin also considered their origin to lie with the family now treated as Nesameletidae. Later, Kluge (2004) grouped the Siphluriscidae, Nesameletidae, Rallidentidae, and Baetidae in a plesiomorphic grouping termed "Tridentiseta" without clarifying the arrangement of the families within this group; the remaining families (Coloburiscidae, Isonychiidae, and Oligoneuriidae) form a monophyletic group Eusetisura within "Bidentiseta", the presence of accessory gills on the mouthparts being considered a shared apomorphy within this group. These arguments seem to imply that maxillary gills (or all accessory gills) are derived characters having evolved independently, and this view is also clearly stated by Staniczek (2010).

However, this argument can not explain why there are no accessory gills in other positions as are often found in other aquatic orders, e. g. like filaments on trichopteran or dipteran larval abdomen. Although gills of mouthparts are a character of Eusetisura, their existence is not necessarily apomorphic. I would suggest that the presence of accessory gills may be a plesiomorphic condition in Ephemeroptera, probably arising from coxal rami (exites or endites). That those structures existed on some insect legs of fossil insects seems indisputable (Kukalová-Peck 1983, 1991, 1997). The question is whether or not they could be modified as accessory gills in mouthparts and legs. The fact that these are found only in some members of the more plesiomorphic families would imply that the ability to develop a coxal gill has been retained and is displayed in some extant taxa of the most ancient lineages.

In the recent consideration of mayfly relationships, Ogden et al. (2009) provided several possible trees on this issue. Except POY topology, all other trees including summary hypothesis tree (Ogden et al. 2009: fig. 7) show that the Siphluriscidae (*Siphluriscus chinensis*) is the







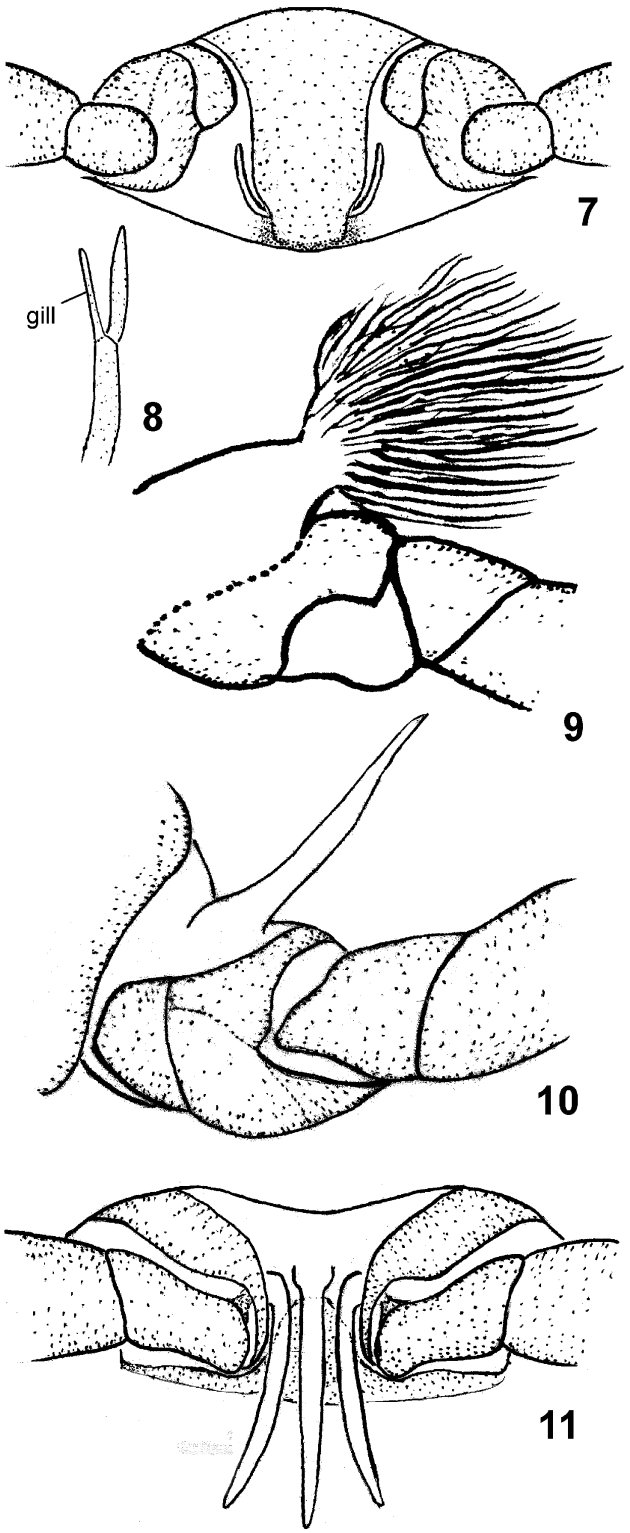
Figs. 4–6. Coxal gills of Baetidae. – **4**. *Baetiella bispinosa*. **5**. *Baetodes huaico*. **6**. *Dicentroptilum papillosum*. – C = Coxa, F = Femur, G = Gill, P = Process, S = dorsal sclerite of coxa, T = Trochanter.

sister group of all other mayflies. Morphologically, this family has most plesiomorphic characters among mayflies. At the same time, it holds the largest number of accessory gills as well, such as two pairs of coxal gills on thoracic forelegs and midlegs. In addition the Baetidae, which have several lineages with accessory gills, also diverged very early from other mayflies in those trees. Another interesting fact is that Gondwanan mayflies usually have more accessory gills on their head and/or thorax.

Exceptions are the sternal gills of *Murphyella* and possibly the gill on the maxillary palp of *Afrobaetodes*. Furthermore, most genera of Baetidae lack accessory gills, and the genera cited here appear to be derived for differing ecological situations. In *Baetodes*, for example, some species have a double gill, some a single, and other species have no accessory gills (Nieto 2003). *Baetodes* differs from other genera of Baetidae in that the gills are in a distal position on the coxa in the membrane between coxa and trochanter (Fig. 5), but all other Baetidae examined have basal coxal gills (membrane between coxae and sterna). Gills of *Afrobaetodes berneri* Demoulin are located closer to the prosternum than to the procoxae (Fig. 7). In both of these cases, these accessory gills can still be homologized with those of other Baetidae by the fact that all have a coxal origin. Even abdominal gills of mayflies are located in differing positions (anterior, posterior, dorsal, ventral) supporting the conclusion that the location of gills with similar origins can change dramatically. In more derived families or groups of families sometimes treated as infraorders, such gills are never found in spite of similar ecological requirements.

Most mayfly accessory gills have the following six characteristics. First, they are thread-like or finger-like filaments or tufts, never plate-like. Second, they are situated on head and/or thorax, never on the abdomen. These two points show that they have a different origin from the abdominal gills. Third, they are arranged segmentally. Fourth, they are usually located on the coxae or the mouthpart homologs of the coxae. These two points infer that they are sub-structures of the legs. Fifth, they are located on membranous areas of the body; and finally, they occur in several mayfly lineages, not a single or rare clade. The latter two points indicate they are likely plesiomorphic structures, although their presence in some Baetidae may be apomorphic. Unfortunately, relationships within Baetidae are poorly understood.

I would suggest that the accessory gills in Ephemeroptera probably arose from original appendages of legs, but have maintained the capacity to persist only in selected families. However, more study of the development of these structures including a detailed comparison with other insect orders is needed.



Figs. 7–11. Accessory gills of Ephemeroptera. – **7–8**. *Afrobaetodes berneri*, prothorax, ventral view (7), maxillary palp (8). **9**. *Siphluriscus chinensis*, forecoxal gill. **10**. *Isonychia georgiae*, forecoxal gill. **11**. *Murphyella needhami*, prothorax, ventral view.

Possible functions of accessory gills

The functions of the accessory gills have only been studied in a most general sense and are believed to be used in respiration. The possibilities of other functions have not been examined, but I might propose a possible filtering function as a subject for further study.

R e s p i r a t i o n . Štys & Soldán (1980), based on anatomical work of Landa (1969), reported that accessory gills (for example in *Isonychia* and *Murphyella*) are connected by their tracheae with both the lateral tracheal trunks and the cephalic gills with the cephalic tracheae. Staniczek (2010) also clearly shows this kind of connection which indicates a respiratory function.

O s m o r e g u l a t i o n . According to Staniczek (2010) this may be another function of the accessory gills.

F i l t r a t i o n o r h e l p i n f i l t e r i n g . The larvae of Coloburiscidae, Isonychiidae, and Oligoneuriidae (Eusetisura) have long and dense hair on their forelegs and mouthparts, and they use them to filter tiny organic materials in the water (Elpers & Tomka 1995, Wallace & O'Hop 1979, Wallace & Merritt 1980). These families also have gills on the forecoxae or on the maxillae which may aid in filtration. The presence of coxal gill tufts and other cephalic gills may have a direct or indirect effect in food filtering, like detaining bigger particles or changing the water current etc. With the exception of Siphluriscidae, the accessory gills of the other families are too small to be used for such a function. Although Siphluriscidae have accessory gills on mouthparts and coxae, they are probably not filterers based on the presence of a scraping type of mandible (Zhou & Peters 2003). Unfortunately, the ecology of *Siphluriscus* is unknown and needs further research.

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Distribution of accessory gills in mayfly larvae (Insecta: Ephemeroptera: Siphlonuroidea, Eusetisura)

Arnold H. Staniczek

Abstract

Mayfly larvae are usually characterised by the presence of paired abdominal gills on the first seven abdominal segments. Numerous taxa assigned to different families however possess additional membranous cuticular outgrowths on different body parts that are generally referred to as accessory gills. These accessory gills can be located on maxillae, labium, thoracic sterna or coxa. The present study compares the different structures of those accessory gills that occur in some taxa of Siphlonuroidea and Eusetisura. The homology of these outgrowths is discussed, and their possible phylogenetic relevance is evaluated.

Keywords: Accessory gills, coxal gills, labial gills, maxillary gills, sternal gills, mouthparts, larva, mayflies, morphology, phylogeny.

Zusammenfassung

Eintagsfliegenlarven besitzen in der Regel paarige Tracheenkiemen an den ersten sieben Abdominalsegmenten. Daneben kommen bei verschiedenen Familien zusätzlich membranöse Ausstülpungen der Kutikula an verschiedenen Körperteilen vor, die im allgemeinen als akzessorische Kiemen bezeichnet und gedeutet werden. Diese akzessorischen Kiemen können an Maxillen, Labium, thorakalen Sterna oder Coxen vorhanden sein. Die vorliegende Arbeit vergleicht die unterschiedliche Ausprägung dieser akzessorischen Kiemen bei Vertretern der Siphlonuroidea und Eusetisura. Die Homologie dieser Strukturen und deren mögliche phylogenetische Relevanz werden diskutiert.

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1 Introduction

Aside from abdominal gills, mayfly larvae of certain taxa can be equipped with membranous outgrowths on such different body parts as coxae, thoracic sterna, maxillae, or labium. These outgrowths are commonly referred to as accessory gills, although their respiratory function has not been experimentally confirmed for most of these taxa. As these different accessory gills are mostly simple membranous tubules or tufts and rarely distributed within mayfly larvae, little attention has been paid to these structures. Information on accessory gills in mayfly larvae is scarce and widely scattered in descriptive literature.

Maxillary gills are, however, present throughout several families of Eusetisura and are also known from some families of Siphlonuroidea. The present study aims to investigate the distribution of different accessory gills in these taxa, to compare their structures, and to discuss their possible homology and phylogenetic relevance. The question of the presence of accessory gills in the groundplan of mayflies is also addressed.

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2 Methods and materials

Photograph series with different focal depths were made from larval heads, legs and dissected mouth parts using a Leica DFC320 digital camera on a Leica Z16 APO microscope and subsequently processed with Leica LAS software to obtain photographs with extended depth of field. The combined photographs were then digitally enhanced using Adobe Photoshop 7.

Specimens used for SEM were dehydrated through a stepwise immersion in ethanol and then dried by critical point drying. The mounted material was coated with a 20 nm Au/Pd layer, examined with a ISI-SS40 scanning electron microscope at 10 kV, and subsequently photographed. Digital photographs were directly acquired by using DISS 5 (point electronic).

Specimens used for microscopic sectioning were dehydrated in ethanol and then stored three times at 50 °C in propan-2-ol for 24 hours each time. Then the material was gradually transferred to paraffin at 50 °C and finally transferred to Paraplast Plus™ at 60 °C. There the specimens were kept under vacuum conditions for 24 hours to optimise their penetration. Finally the material was embedded in Paraplast Plus™. Sections of 5 µm thickness were obtained by using a Leitz 1516 rotation microtome. Sections were stained with Delafield's hematoxylin and counterstained with eosin. Photographs of sections were taken with a Canon Powershot S45 digital camera on a Leica DMR microscope and digitally processed with Adobe Photoshop 7.

The following material (all deposited in SMNS) was used in this study (number of examined specimens in brackets):

Nesameletidae

Nesameletus ornatus: New Zealand, Coromandel Peninsula, Whangaeterenga Stream, 6.IV.1993, Staniczek leg. (20).

Ameletoides lacusalbinae: Australia, New South Wales, Hedley Creek, 9.II.1966, Riek leg. (3).

Rallidentidae

Rallidens mcfarlanei: New Zealand, Northland, Wekaweka, Ngatahuna Stream, 10.IV.1993, Staniczek leg. (5).

Rallidens sp.: New Zealand, South Canterbury, Otaio River, 23424, 56223, 8.II.2000, T. R. Hitchings leg. (1).

Siphluriscidae

Siphluriscus chinensis: China, Zhejiang Province, Long-Quan county, Guan-Pu-Yang, Nang-Ju, 15.VIII.1994, Zhou leg. (1).

Coloburiscidae

Coloburiscus humeralis: New Zealand, Stewart Island, unnamed creek near Long Harry Hut, 4.III.1993, Staniczek leg. (45).

Coloburiscoides sp.: Australia, Victoria, Powelltown, Ada River, 22.IV.1993, Staniczek leg. (12).

Murphyella needhami: Chile, Nuble, Las Trancas, 2.III.1968, Peña & Flint leg. (1).

Isonychiidae

Isonychia tusculanensis: USA, Tennessee, Great Smoky Mountains National Park, Little River at Metcalf Bottoms Trailhead, 7.XII.2001, Jacobus leg. (3).

Oligoneuriidae

Oligoneuriella rhenana: Germany, Baden-Württemberg, Oberriexingen, River Enz, 22.VII.1996, Staniczek leg. (20).

Abbreviations

ca	cardo
cc	chloride cell
cx	coxa
cxg	coxal gill
galc	galeolacinia
lbg	labial gill
lbr	labrum
md	mandible
mga	anterior maxillary gill
mgp	posterior maxillary gill
mtc	musculus tentorio-cardinalis
mx	maxilla
mxg	maxillary gill
pgl	paraglossa
plb	labial palp
pm	postmentum
pmx	maxillary palp
prm	prementum
st	stipes
tra	trachea
tr	trochanter

3 Results

Nesameletidae

Nesameletus ornatus (Eaton, 1833) (Figs. 1–9)

The Nesameletidae is a small mayfly family of amphinotic distribution that includes the three described genera *Nesameletus* (New Zealand, see Hitchings & Staniczek 2003), *Ameletoides* (Australia, see Tillyard 1933), and *Metamonius* (South America, see Mercado & Elliot 2004). Phenetically, these genera are very similar to each other, so the investigation of the New Zealand species *Nesameletus ornatus* may stand representatively for the entire Nesameletidae.

The head of *N. ornatus* is slightly opisthognathous, i. e. the mouth parts are directed in posteroventral direction (Fig. 1). As usual in mayflies, the larval maxilla is composed of cardo, a stipes bearing a 3-segmented maxillary palp, and distal maxillary lobes that are medially fused to form a so-called galeolacinia. Different from other siphlonuroid taxa, however, is the membranous connection between cardo and stipes that is everted to form a membranous tubule. The base of this tubule is particularly formed by the lateral and anterior membrane between cardo and stipes. The basal half of the tubule is directed dorsally. About at half length the tubule bends so that its apical half proceeds in anterolateral direction (Figs. 1–3). The tip of the maxillary tubule thus points outwards and often can be seen in lateral view (see also Fig. 9 for spatial location within the head). The tubule itself is entirely membranous and, except of very few tiny setae that are only recognised in high SEM magnification, not equipped with any other cuticular structure. The maxillary gill is also lacking chloride cells.

Slide preparations of the maxilla do not reveal any peculiarities in the structure of the maxillary gill, but in histological cross sections the branching of a small trachea from the main maxillary trachea and its subsequent invasion into the lumen of the maxillary gill can be observed (Figs. 4–8).

Rallidentidae

Rallidens mcfarlanei Penniket, 1966; *R.* sp.
(Figs. 10–13)

The Rallidentidae is a family endemic to New Zealand with one described species, *Rallidens mcfarlanei*. However, the material for this investigation is partly also taken from a second species that will be described elsewhere (STANICZEK & HITCHINGS in prep.).

Larvae of *Rallidens* (Fig. 11) are superficially very similar to *Nesameletus*, but equipped with additional ventral fibrillar gill tufts at the abdominal gills. The mouthparts are orthognathous and of different shape: The entire maxilla of *Rallidens* appears rather broad when compared to other taxa of Siphlonuroidea. The stipes considerably widens in its apical half, the galeolacinia is almost of square shape (Figs. 12, 13). Stipes and galeolacinia only meet on a short distance in their medial halves. The insertation of the maxillary palp is located at the anterior (oral) side of the maxilla (Fig. 13), so the palp is not visible in posterior view (Fig. 12).

Apart from these differences, there is a maxillary gill developed that has a striking similarity to the corresponding structure in Nesameletidae. As in *Nesameletus*, the anterior and lateral membrane between cardo and stipes is everted to form a membranous tubule that is directed anterolaterally. In side view onto a head of *Rallidens*, the tip of the maxillary gill can be seen from externally (Fig. 10). The maxillary tubule is neither equipped with chloride cells nor with other cuticular structures, but a tracheal supply can be assumed.

Siphluriscidae

Siphluriscus chinensis Ulmer, 1920
(Figs. 14–18)

The enigmatic larva of the sole species of Siphuriscidae was only recently discovered by ZHOU and described in detail by ZHOU & PETERS (2003).

The larva of *Siphluriscus chinensis* resembles very much the larvae of Nesameletidae in general appearance and opisthognathous mouthparts, i. e. the mouthparts are slightly directed backwards (Fig. 14), the mandibular incisors are fused to form a scraping tool, and the maxilla is of similar proportions as in Nesameletidae.

As in Nesameletidae and Rallidentidae, a membranous outgrowth can be observed at the anterolateral membranous area between cardo and stipes (Figs. 15, 16). This anterior maxillary gill has a broad base that branches off after a short distance, and apically each branch splits off again. The entire anterior maxillary gill is directed dorsolaterally. In contrast to the previously decribed taxa, in *S. chinensis* another, posterior maxillary gill tuft can also be found (Fig. 17). In the single specimen that was available to me this posterior maxillary gill is pectinate, i. e. comblike. On both anterior and posterior maxillary gill, coniform chloride cells are scattered on the membranous surface (Fig. 15).

The general shape of the labium, especially the elongated postmentum, is also very similar to *Nesameletus*, but the labium of *Siphluriscus* laterally bears two distinct pairs of membranous fringes with successively branched tubules (Fig. 18). As the medial insertion of the long musculus tentorio-praementalis clearly denotes the border between post- and prementum, it becomes obvious that both pairs of labial gills originate at the lateral borders of the postmentum. On the labial gill surface also numerous coniform chloride cells can be observed.

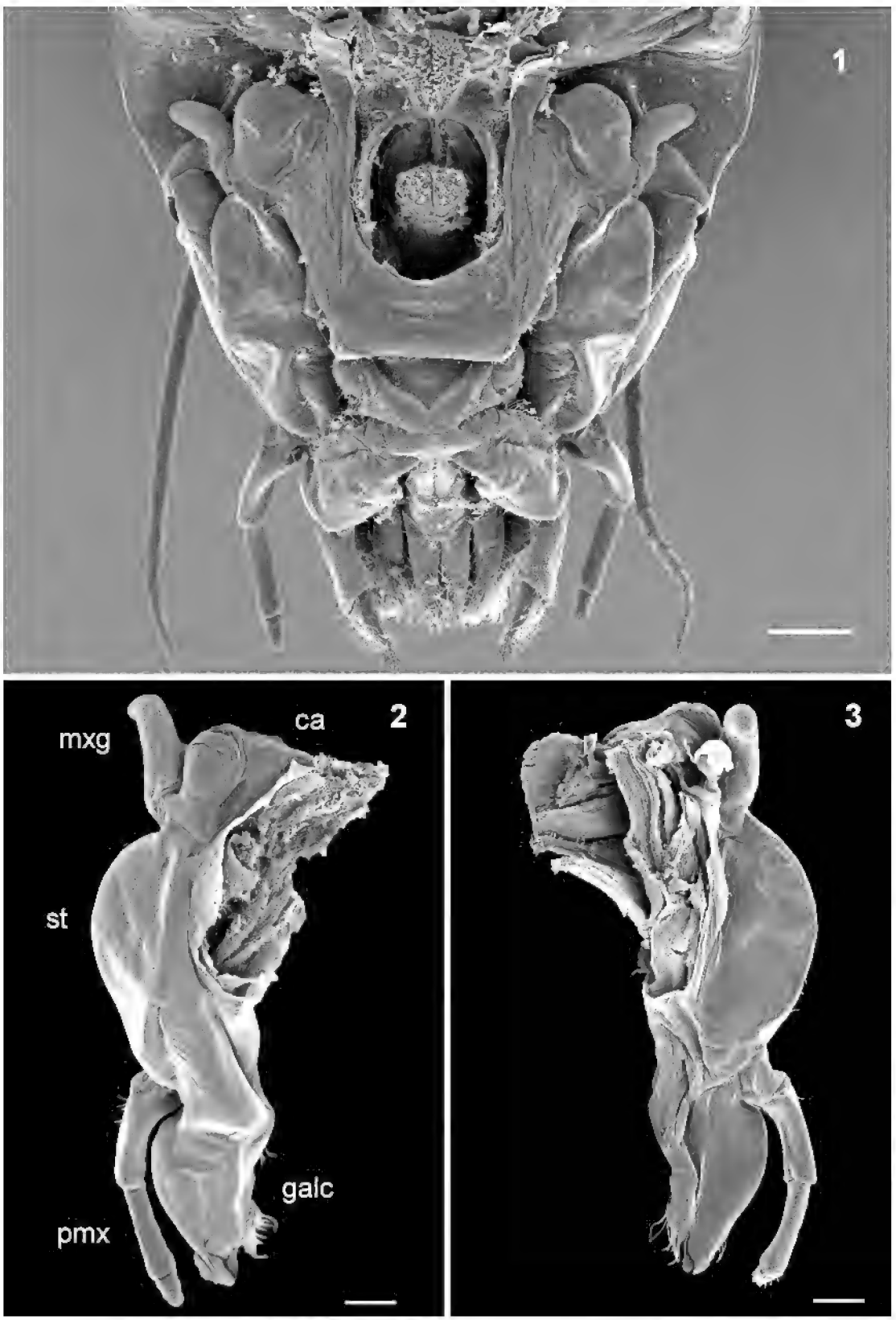
Finally, there are also coxal gill fringes developed in the pro- and mesothorax at the medial membrane between each coxa and sternal sclerite (Fig. 14). The coxal gills are also supplied with a trachea. Tracheation of maxillary and labial gills can also be observed.

Coloburiscidae

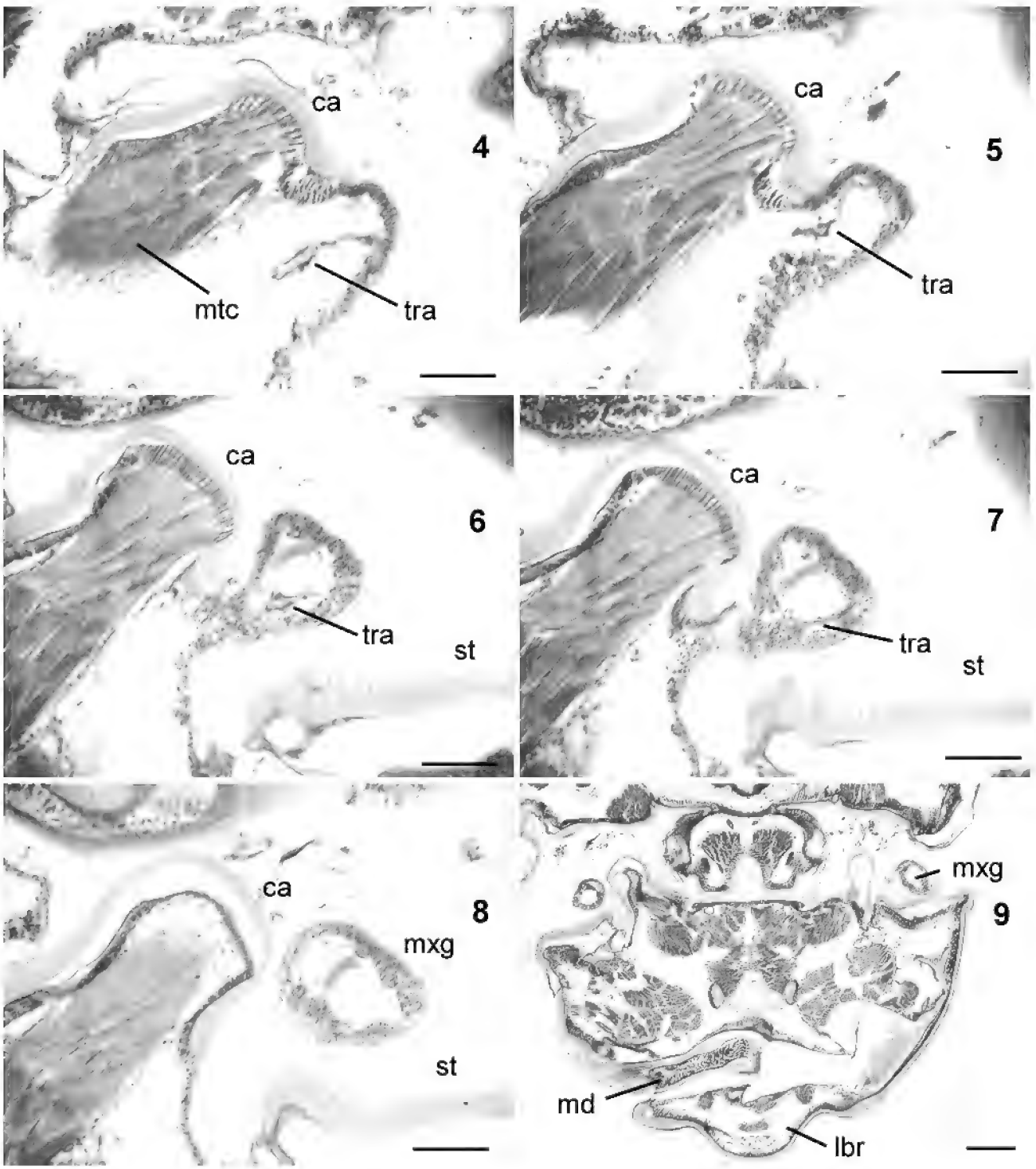
Coloburiscus humeralis Walker, 1853; *Coloburiscoides* sp.; *Murphyella needhami* Lestage, 1930
(Figs. 19–31)

Coloburiscidae is another amphinotic family with three described genera: *Coloburiscus* (New Zealand, see WISELY 1961), *Coloburiscoides* (Australia, see SUTER et al. 2009), and *Murphyella* (South America, see DOMÍNGUEZ et al. 2006). In the different genera of Coloburiscidae there is a variety of different accessory gills present, although the general appearance of these genera is very similar. This is for instance reflected in the mouthparts by a peculiar arrangement of the maxillary and labial palps (Figs. 20, 26, 28). The palps insert on the posterior (aboral) side of stipes and prementum. The basal palp segments are directed downwards. The apical palp segments are elongated and directed anteriorly, thus covering the mouthparts ventrally (Figs. 20, 25, 31).

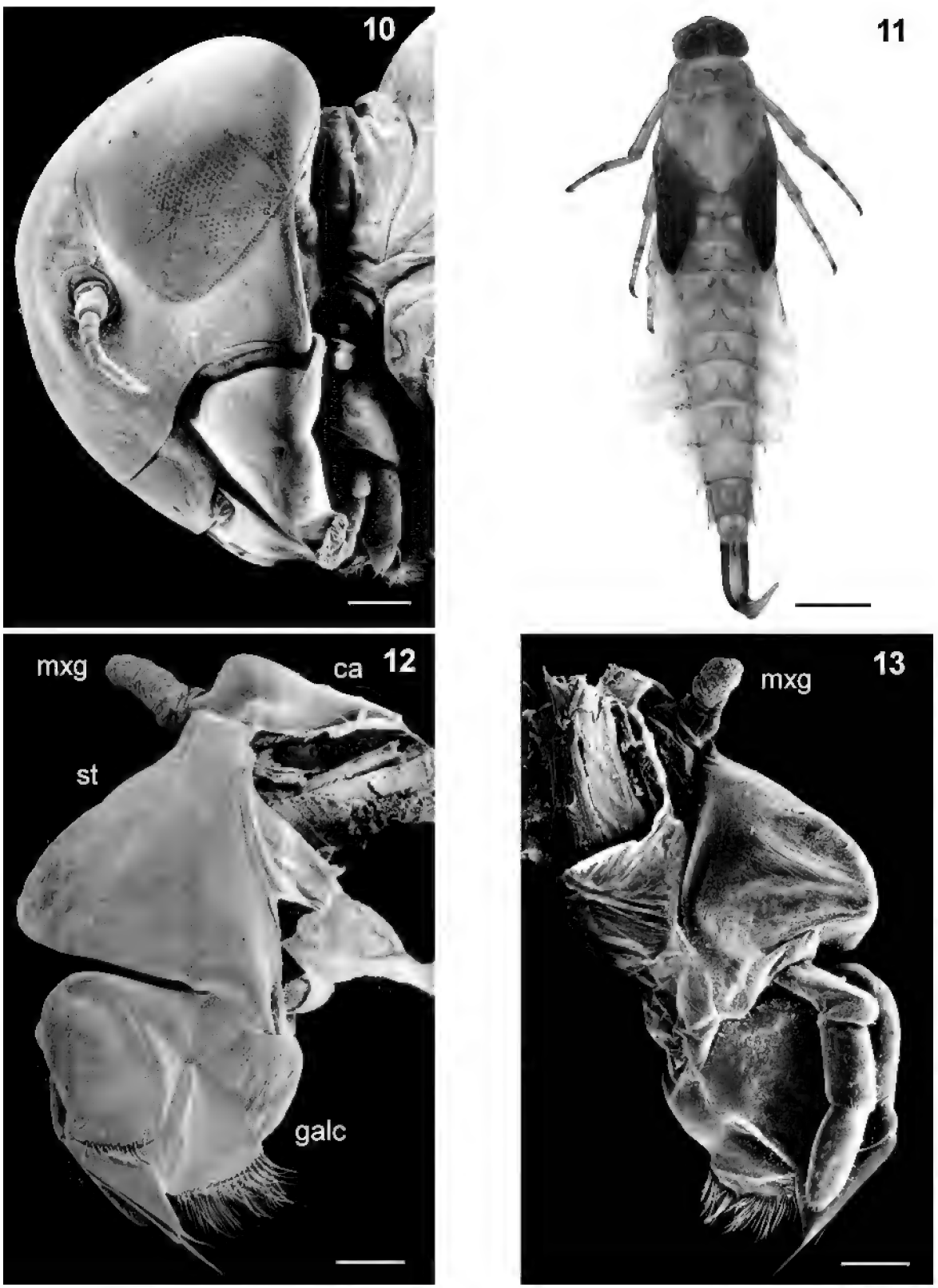
In *Coloburiscus humeralis* (Figs. 19–23) the posterior (aboral) side of the maxilla is equipped with two tubular, membranous outgrowths that have a short common stem (Fig. 20). This common stem originates at the membranous area between cardo and stipes, medially extending to the likewise membranous area between maxilla and labium (Fig. 20). Each branch of the maxillary gill forms a simple, membranous, finger-like protuberance. The maxillary gills are directed ventromedially. The membranes of both branches and stem are pigmented in some specimens; internally the gill is supplied with a trachea that branches off the main trachea supplying the maxilla (Fig. 21). There are no coxal or labial gill tubules present.



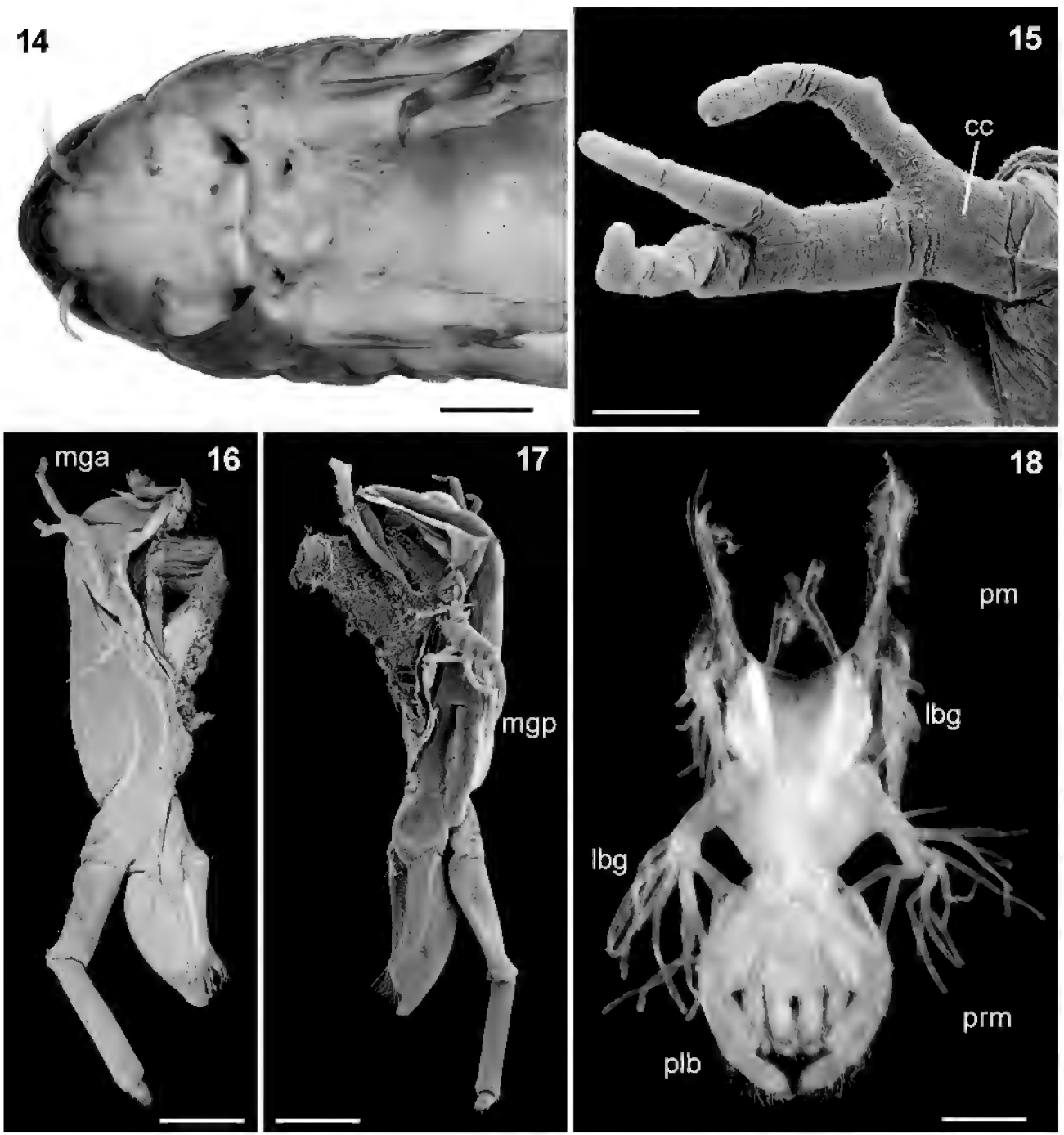
Figs. 1–3. *Nesameletus ornatus*. – **1**. Exarticulated head in posterior view. **2**. Left maxilla in posterior view. **3**. Left maxilla in anterior view. – Abbreviations see chapter 2. – Scale bars: 0.2 mm.



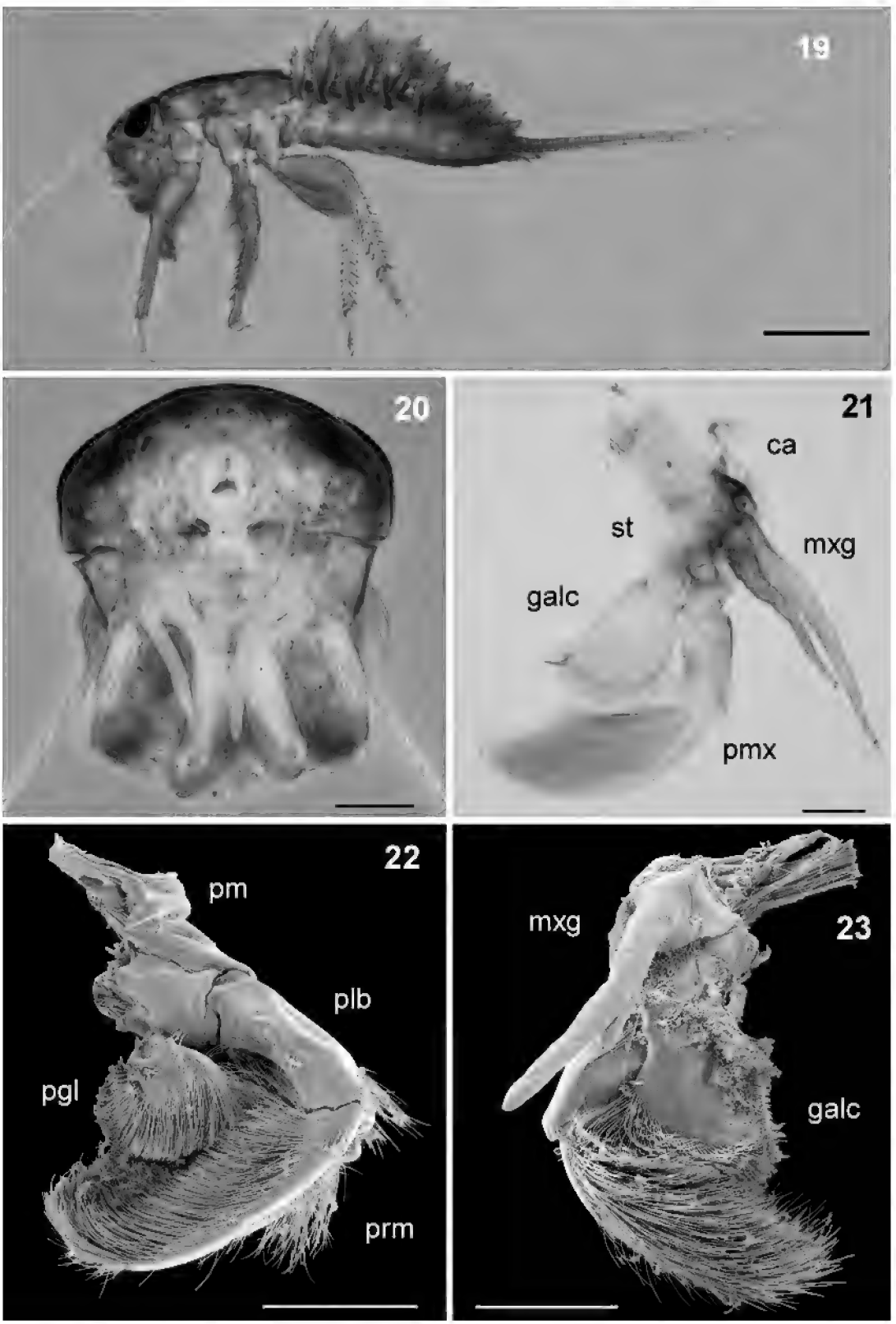
Figs. 4–9. *Nesameletus ornatus*. – **4–8**. Histological cross sections through left maxilla from caudal to cranial. **9**. Histological cross section through lower head. – Abbreviations see chapter 2. – Scale bars: 50 µm (4–8), 70 µm (9).



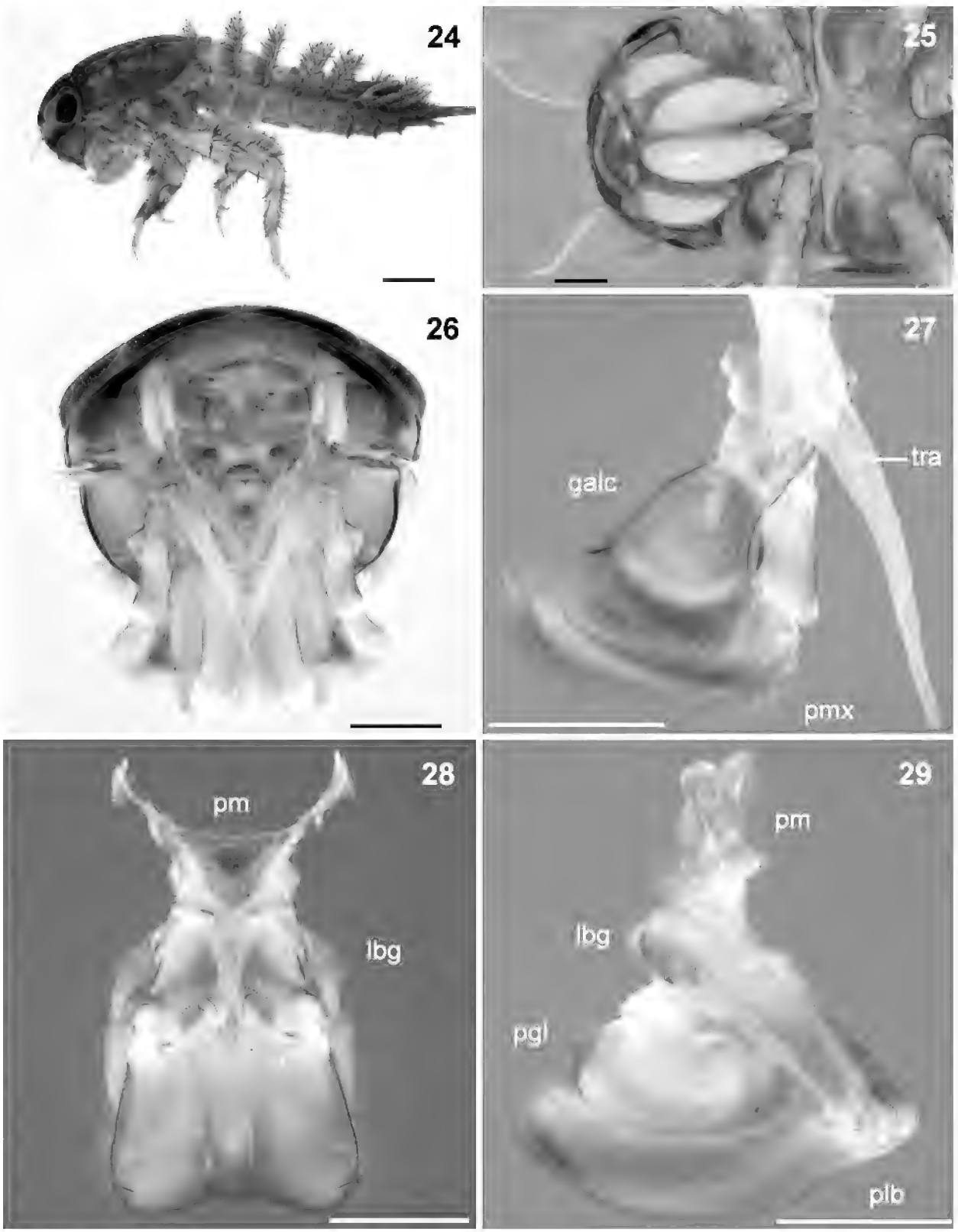
Figs. 10–13. *Rallidens* spp. – **10**. *R. mcfarlanei*, head in lateral view. **11**. *R. mcfarlanei*, larva in dorsal view. **12**. *R.* sp., left maxilla in posterior view. **13**. *R.* sp., left maxilla in anterior view. – Abbreviations see chapter 2. – Scale bars: 0.2 mm (10), 2 mm (11), 0.1 mm (12, 13).



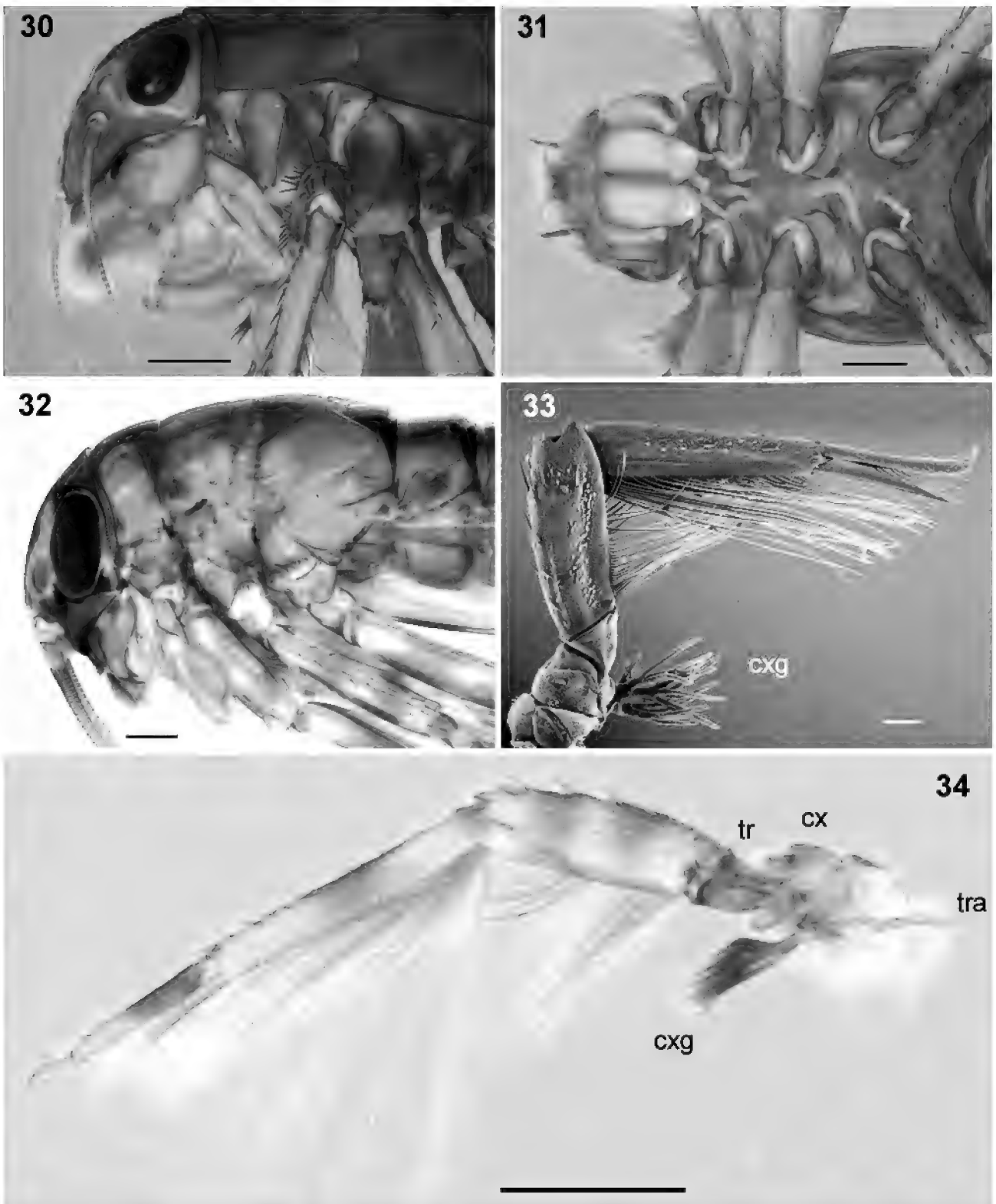
Figs. 14–18. *Siphluriscus chinensis*. – **14**. Head and thorax in ventral view. **15**. Anterior maxillary gills. **16**. Right maxilla in anterior view. **17**. Right maxilla in posterior view. **18**. Labium in posterior view. – Abbreviations see chapter 2. – Scale bars: 250 µm (14), 100 µm (15), 50 µm (16, 17), 200 µm (18).



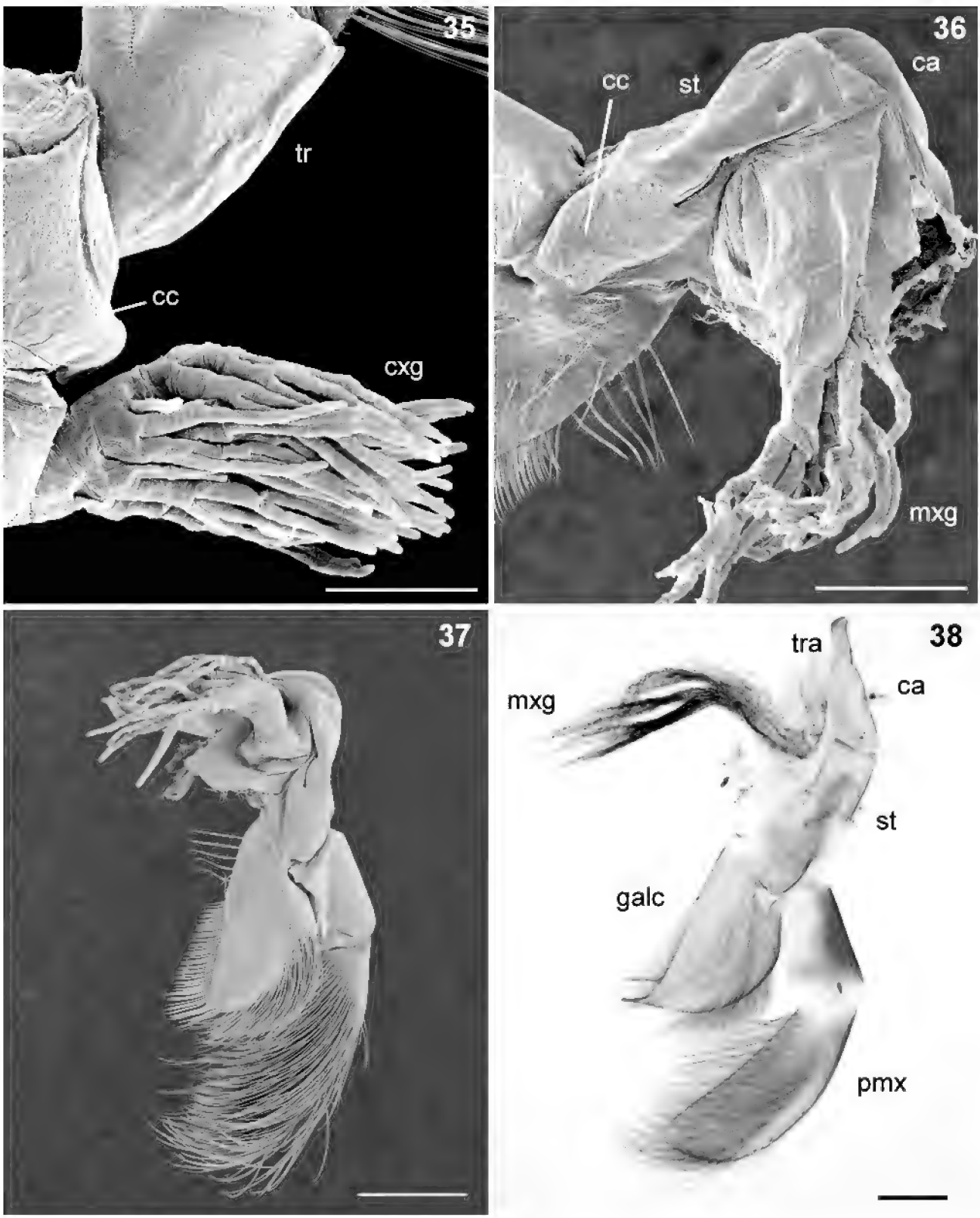
Figs. 19–23. *Coloburiscus humeralis*. – **19**. Larva in lateral view. **20**. Exarticulated head in posterior view. **21**. Right maxilla in medial view. **22**. Labium in lateral view. **23**. Left maxilla in medial view. – Abbreviations see chapter 2. – Scale bars: 2 mm (19), 0.5 mm (20), 0.2 mm (21), 0.5 mm (22), 40 µm (23).



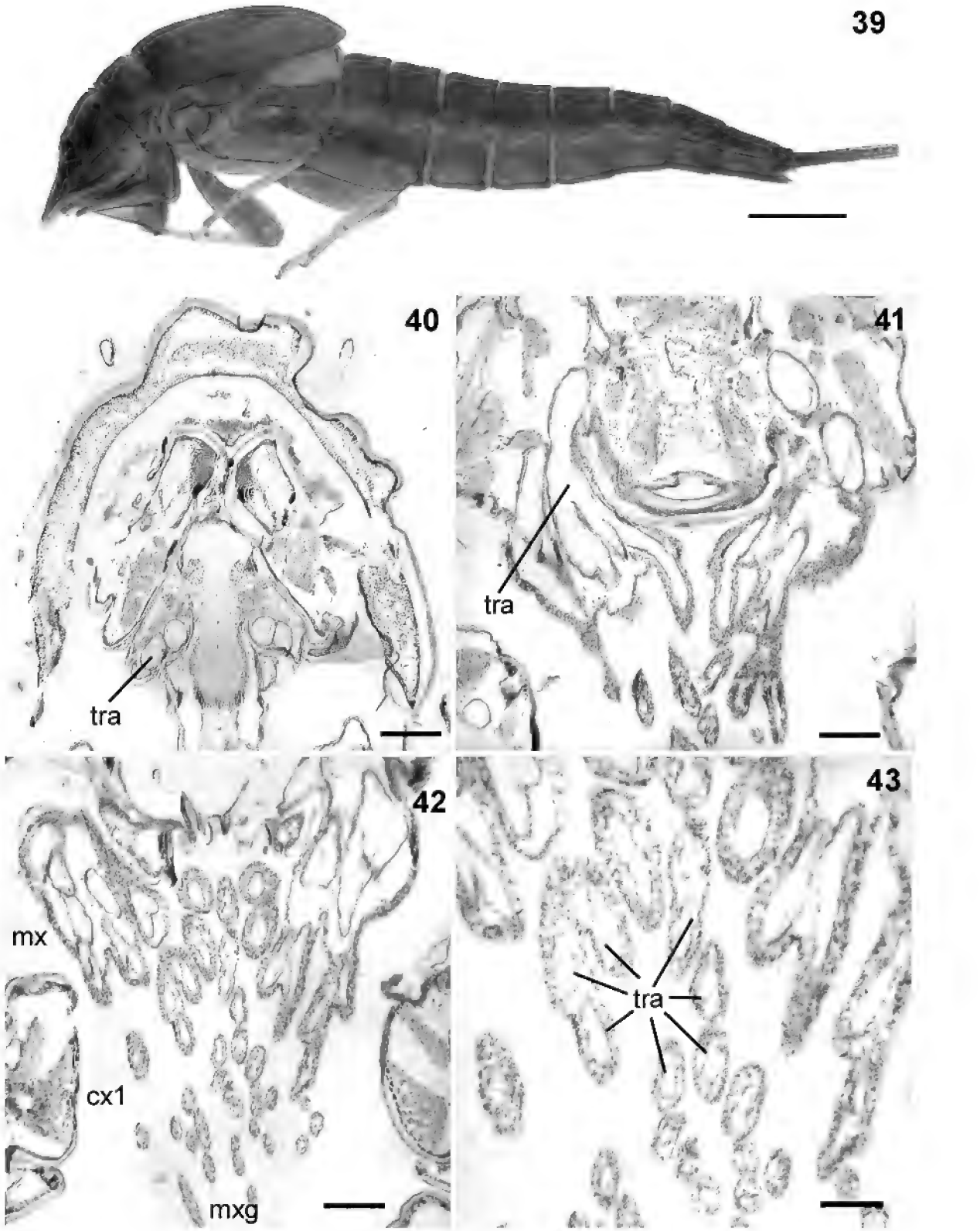
Figs. 24–29. *Coloburiscoides* sp. – **24**. Larva in lateral view. **25**. Head and thorax in ventral view. **26**. Exarticulated head in posterior view. **27**. Right maxilla in medial view. **28**. Labium in posterior view. **29**. Labium in lateral view. – Abbreviations see chapter 2. – Scale bars: 1 mm (24), 0.5 mm (25–29).



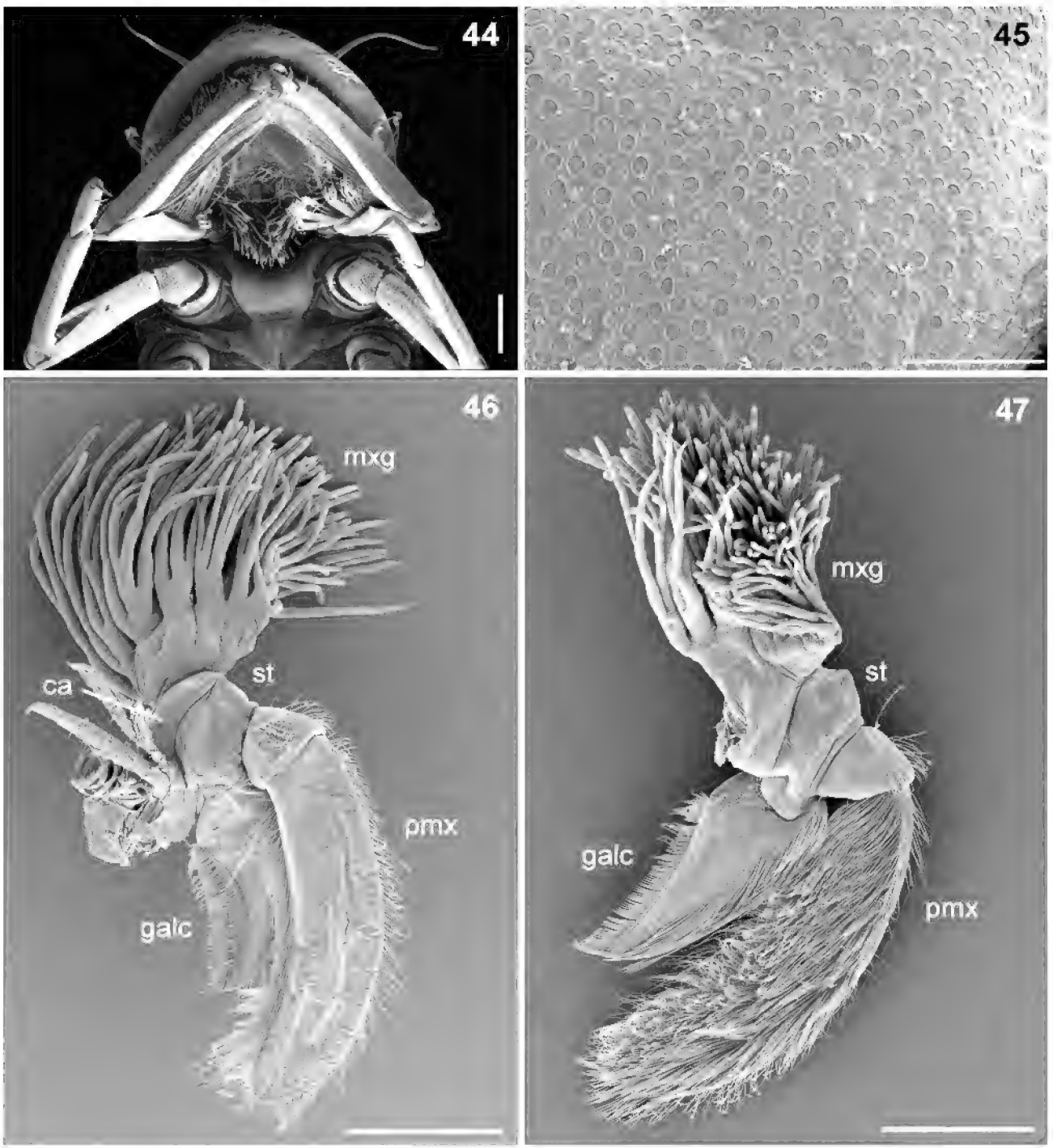
Figs. 30–34. *Murphyella needhami*, *Isonychia tusculanensis*. – **30**. *M. needhami*, head and thorax in lateral view. **31**. *M. needhami*, head and thorax in ventral view. **32**. *I. tusculanensis*, head and thorax in lateral view. **33**. *I. tusculanensis*, left foreleg in anterior view. **34**. *I. tusculanensis*, right foreleg in anterior view. – Abbreviations see chapter 2. – Scale bars: 1 mm (30, 31, 34), 0.5 mm (32), 0.1 mm (33).



Figs. 35–38. *Isonychia tusculanensis.* – **35**. Coxal gill. **36**. Base of maxilla with maxillary gill. **37**, **38**. Right maxilla in posterior view. – Abbreviations see chapter 2. – Scale bars: 0.2 mm (35, 36, 38), 0.3 mm (37).



Figs. 39–43. *Oligoneuriella rhenana*. – **39**. Larva in lateral view. **40**. Histological horizontal section through head. **41**, **42**. Horizontal sections through maxilla at different levels. **43**. Section through maxillary gill tubules. – Abbreviations see chapter 2. – Scale bars: 2 mm (39), 70 µm (40), 150 µm (41, 42), 50 µm (43).



Figs. 44–47. *Oligoneuriella rhenana*. – **44**. Head and thorax in ventral view. **45**. Chloride cells on surface of maxillary gills. **46**. Left maxilla in dorsal view. **47**. Right maxilla in ventral view. – Abbreviations see chapter 2. – Scale bars: 400 µm (44), 50 µm (45), 500 µm (46, 47).

In *Coloburiscoides* sp. (Fig. 24) two pairs of simple tubular outgrowths can be observed, each at the posterior (aboral) side of maxilla and labium (Fig. 26). Both tubules have separate origins: The dorsal tubule originates from the same position as the maxillary gill in *Coloburiscus*, namely from the membranous area close to cardo and basal part of stipes (Fig. 27). The ventral tubule is approximated to the labium. It originates laterally of the labial palp at the lateral side of the basal prementum and is also darkly pigmented (Figs. 28, 29). A trachea can be observed that deeply reaches into the lumen of the tubules (Fig. 27). Both gill tubules are not equipped with chloride cells, and on the surface only very few short setae can be observed.

A yet different arrangement of these outgrowths can be found in the mouthparts of the sole known species of the third genus, *Murphyella needhami*. While this is the only described mayfly species entirely lacking abdominal gills, there are multiple accessory gills present. The distribution of these accessory gills can be best described as a mix of characters that occur in the previous two genera: The maxillary gill has the same structure as in *Coloburiscus*, a pair of two tubules with common stem, but additionally a labial gill as in *Coloburiscoides* can be observed. Both labial and maxillary gills can be seen in lateral view (Fig. 30). Additionally, there is also a pair of procoxal gills present. Each gill originates as simple short tubule from the inner membrane between procoxa and prosternum (Fig. 31). Finally, there are even three unpaired sternal gills present that protrude as medial tubule from the middle of each thoracic sternum (Fig. 31). However, Štys & Soldán (1980) and Zhou (2010) report certain variability in the formation of maxillary and labial gills in this species.

Isonychiidae

Isonychia tusculanensis Berner, 1948
(Figs. 32–38)

The Holarctic Isonychiidae is a widespread taxon with currently 34 described species in a single genus (see Kondratieff & Voshell 1984, Tiunova et al. 2004).

The maxilla of the North American species *Isonychia tusculanensis* (Fig. 32) bears on its posterior side a membranous gill tuft (Figs. 37, 38). The maxillary gill tuft has a common stem that originates within the posterior maxillary membrane medially of the stipes and ventrally of the cardo. The distal part of the accessory gill is split up into a bundle of membranous tubules. The maxillary gill is supplied with a thick and dark pigmented tracheal branch that invades deeply into the accessory gill (Fig. 38). *I. tusculanensis* is also equipped with a pair of prothoracic coxal gills that are located medially of each procoxa (Figs. 33, 34, 35). Each coxal gill is orientated ventrally and distally split up into a bunch of tubules. The gill tufts are supplied by a darkly pigmented tracheal branch that splits off into numerous, also darkly pigmented tracheoles (Fig. 38). Although there are numerous coniform chloride cells present on trochanter, coxa, and stipes, the chloride cells do not extend to the maxillary and coxal gill membranes (Figs. 35, 36).

Oligoneuriidae

Oligoneuriella rhenana (Imhoff, 1852)
(Figs. 39–47)

The Oligoneuriidae is – apart from the Australian Realm – worldwide distributed with a distributional centre in the Oriental Realm. It includes about 50 described species in 12 genera (see Kluge 2004, Pescador & Peters 2007).

The head of the European species *Oligoneuriella rhenana* (Fig. 39) is prognathous, i. e. the mouthparts are directed anteriorly. They are ventrally covered by a highly modified labial shield (Fig. 44), so the maxilla is hardly seen in ventral view. Only the voluminous maxillary gill tufts are visible covering the prosternum between the forecoxae. The maxillary gills are directed posteroventrally and surround the labial shield from posterior. The maxillary gill tuft has a common stem that occupies the entire membranous area medially of the stipes (Figs. 46, 47). In aboral (ventral) view the cardo is not even visible and superposed by the massive development of the maxillary gill (Fig. 47). Only in oral (dorsal) view a cardinal sclerite can be observed (Fig. 46). High SEM magnification reveals that the maxillary gills are entirely laced with numerous coniform chloride cells (Fig. 45). Between the coniform chloride cells, there are fewer bulbiform chloride cells scattered. Histological cross sections show the massive development of the trachea supplying the maxillary gills (Figs. 40–43). Almost the entire lumen of the maxillary gills is filled by the voluminous maxillary trachea that branches into multiple tracheoles, deeply invading each maxillary tubule (Fig. 43).

4 Discussion

Membranous tubules or tufts associated with other tagmata than the abdomen are known to occur in six mayfly families and are commonly referred to as accessory gills. In Baetidae, these structures are only present in a few genera. Zhou (2010) lists species of *Afrobaetodes*, *Baetiella*, *Baetodes*, *Dicentroptilum*, and *Heterocloeon* that possess accessory gills. They are mostly located between coxae and sterna, or sometimes between coxae and trochanteres. Apart from these genera, accessory gills in Baetidae are also known from *Camelobaetidius* (Domínguez et al.

2006). ZHOU (2010) also noted additional maxillary gills in *Afrobaetodes berneri*. There is even the presence of a tubular outgrowth on the first segment of the labial palp reported in a species of *Afrobaetodes* (GATTOLLIAT & SARTORI 1999). So there are at least three different types of accessory gills reported in Baetidae. However, the vast majority of Baetidae do not possess accessory gills at all.

In contrast, all species of six other families of Ephemeroptera wear some kind of accessory gills: In the Siphlonuroidea it is the Nesameletidae, Rallidentidae, and Siphluriscidae, in the Eusetisura it is Coloburiscidae, Isonychiidae, and Oligoneuriidae. Apart from their accessory gills, these six families each have several morphological characters that can be interpreted as autapomorphic (KLUGE 2004), so we can consider each of these taxa to be monophyletic. The structure of the respective gills within the different families is quite uniform, so we can also assume that these structures are each homologous within the respective families. As these specific gills are reported from each species in the respective families, we can certainly also hypothesise the presence of specific accessory gills in the respective stem species of these taxa and thus attribute the specific accessory gills to the respective groundplans of these six groups. This leads to the questions if the different types of accessory gills are homologous to each other, if they could be interpreted as synapomorphic characters that account for a closer phylogenetic relationship of these taxa, if accessory gills are even plesiomorphic and already present in the groundplan of Ephemeroptera, or if these structures have evolved several times independently within the different groups. All these hypotheses were postulated by different authors, but to evaluate this problem, we have first to take a closer look at the different types of gills in the different families.

Though the maxillary tubules in Nesameletidae and Rallidentidae are rather simple structures, they resemble each other in position (both gills originate at the anterolateral edge of the maxilla), shape, and spatial orientation. Furthermore both maxillary gills lack chloride cells, are supplied by a branch of the maxillary trachea, and are equipped with few short setae. So these similarities would indeed point to an interpretation of the maxillary tubules of Nesameletidae and Rallidentidae as homologous structures, and this was also a reason for PENNIKET (1966) to assume a closer relationship of these taxa. At that time the larva of *Siphluriscus chinensis* was not yet known, which shares striking similarities of mandible, maxilla and labium with Nesameletidae (ZHOU & PETERS 2003). Based on these characters, HITCHINGS & STANICZEK (2003) rather assumed a phylogenetic sequence of Rallidentidae + (Nesameletidae + Siphluriscidae). The same phylogeny was confirmed by processing a morphological dataset in a comprehensive cladistic analysis of Ephemeroptera by OGDEN et al. (2009). However, adding molecular data to this morphological dataset suggested a sistergroup relationship of Nesameletidae + Rallidentidae, placing Siphluriscidae as sister to all other Ephemeroptera in the combined analysis (Fig. 48).

The presence of ventral abdominal gill tufts in Rallidentidae and Eusetisura, similarities in the wing venations of Rallidentidae and Isonychiidae, and the presence of maxillary gills in Nesameletidae, Rallidentidae, and Eusetisura led DEMOULIN (1969) to conclude a closer relationship of these taxa. However, KLUGE (2004) realised that the maxillary gills in Coloburiscidae, Isonychiidae, and Oligoneuriidae have a different origin from the maxillary gills present in Nesameletidae and Rallidentidae. In the latter, the maxillary gills evert from the anterolateral membrane between cardo and stipes, while in the former three families the maxillary gills originate from the posterior (aboral) side of the maxilla. Consequently, KLUGE (2004) assumed an independent origin of the maxillary gills in these groups and assessed the maxillary gills of Coloburiscidae, Isonychiidae, and Oligoneuriidae as autapomorphic character of Eusetisura.

In his phylogeny of Heptagenioidea, MCCAFFERTY (1991) assumed maxillary gills as a derived groundplan character of this group and suggested their subsequent loss in Heptageniidae. Earlier also EDMUNDS (1973) assumed a common phylogenetic origin of Coloburiscidae, Isonychiidae, and Oligoneuriidae. While these authors differ in the specific branching sequences of these taxa, their underlying assumption is certainly a homology and derived character state of the maxillary gills.

However, if the phylogeny of OGDEN et al. (2009) is correct in assuming a paraphyletic Eusetisura, then the accessory gills in these taxa are either convergent developments, or are rather plesiomorphic characters that must be traced back to the groundplan of Ephemeroptera.

The evaluation of coxal and thoracic gills is even more difficult, as tufted coxal gills are only scattered within Baetidae and universally only present in Isonychiidae and Siphluriscidae. In Coloburiscidae, only *Murphyella needhami* has simple tubular coxal gills developed. So regardless if we consider Eusetisura as monophyletic or paraphyletic, the occurrence of coxal gills in the different taxa can likewise only be interpreted either as independently evolved or as a remnant of a plesiomorphic groundplan condition.

The latter view has been put forward by ZHOU (2010) who not only assumes a serial homology of coxal, labial and maxillary gills in all these taxa, but also assumes their presence already in the stem species of mayflies, thus interpreting these structures as plesiomorphic groundplan characters of Ephemeroptera. Following KUKALOVÁ-PECK's (1983) ideas on insect leg segmentation, he derives coxal, labial and maxillary gills from "coxal rami (exites or endites)" of early Pterygota.

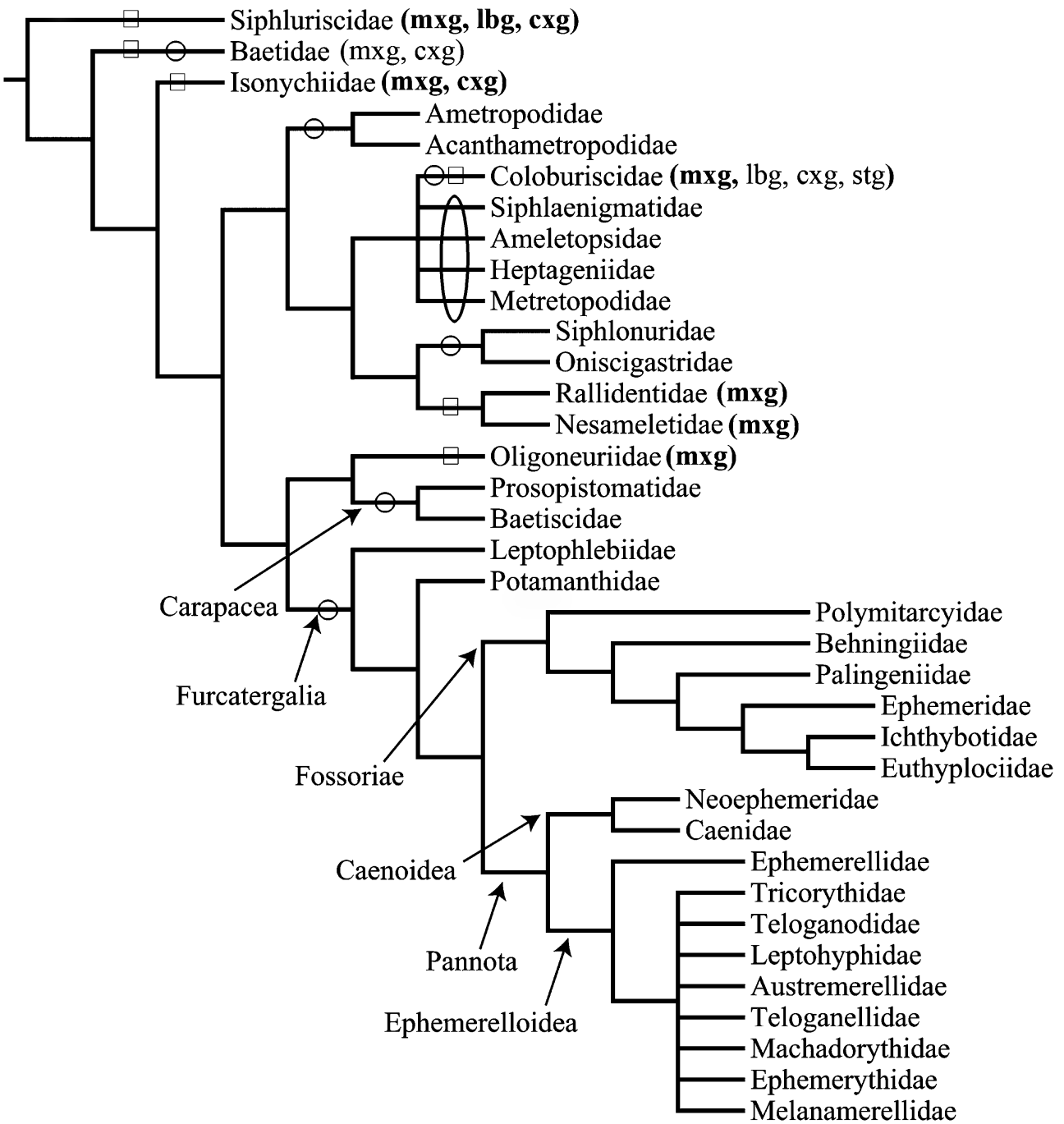


Fig. 48. Distribution of accessory gills in mayfly larvae. – Phylogeny after OGDEN et al. (2009). Explanation of squares and circles see chapter 4.

This theory at first hand seems to be supported by the phylogenetic analysis of OGDEN et al. (2009), in which the first three branches are represented by Siphluriscidae, Baetidae, and Isonychiidae. However, if we assume the presence of maxillary and coxal gills in the stem species of Ephemeroptera, we must also assume a convergent loss of these structures at least seven times (indicated by circles in Fig. 48). On the other hand, if we postulate the independent acquisition of these characters within Ephemeroptera, we would have to assume this at least six times (indicated by squares in Fig. 48). Apart from parsimony, there are also other difficulties with the derivation of coxal and maxillary gills from leg exites: coxal gills of all investigated mayfly larvae always originate from the ventral (inner) side of the coxosternal membrane, but the leg *ex*ites as shown by KUKALOVÁ-PECK (1983) in Diaphanopterodea and later in generalised schemes of insect legs (KUKALOVÁ-PECK 1987) are always located at the dorsal (outer) sides of the leg segments. Thoracic styli in extant Archaeognatha, often also interpreted as remnants of leg exites, are also located at the dorsal side of the coxa. It is also difficult to imagine the evolutionary development of accessory gills from arthropod endites: In Crustacea, endites are generally associated with food processing and not with oxygen intake, so there are rather heavily sclerotised structures developed than membranous devices. Another point is the obvious lack of coxal gills in otherwise well preserved early Carboniferous (STANICZEK 2007) or Permian (KUKALOVÁ 1968) stem group fossils, in which most delicate abdominal gills are preserved and clearly visible. Finally, there are neither coxal endites reported from primarily wingless insects nor from Odonata or basal Neoptera. All these considerations rather do not point to the presence of coxal or maxillary gills in the groundplan of Ephemeroptera. After all, the sternal thoracic outgrowths in *Murphyella needhami* definitely cannot be interpreted as remnants of leg exites, but must be rather explained as new evolutionary acquisition. These tubular outgrowths are rather simple structures, so convergent developments may easily have taken place. A multiple convergent development of tracheal gills of different body parts is also assumed within other aquatic insect orders like Plecoptera (ZWICK 2009). I do not categorically rule out the possibility that underlying discontinuous activity of ancient leg genes (see STURM 1994) may trigger the development of coxal or maxillary gills when needed, but I do not necessarily assume their presence *per se* in the groundplan of Ephemeroptera. However, with an improved phylogeny of Baetidae and Ephemeroptera in general it would be easier to assess if accessory gills were already present in earliest Baetidae or successively developed in the different genera.

Though these membranous accessory structures are generally referred to as accessory gills, their actual role in respiration has, to my knowledge, never been tested experimentally. The fact that all coxal and maxillary gills are membranous and supplied by tracheal branches makes it probable that it is indeed their prevailing function to aid in respiration. ZHOU (2010) also discusses a possible function in nutrition by filtering food particles, but I do not consider this to be likely, as the gill tubules are much too thick to serve as filtering device for detritus. I also do not know of any observation that would support this hypothesis. On the contrary, ELPERS & TOMKA (1992) in their detailed observation of the feeding behaviour of *O. rhenana* clearly proved that maxillary gills are not involved in food acquisition.

Osmoregulatory function can be ruled out for the accessory gills of most taxa, as only in Siphluriscidae and Oligoneuriidae the presence of chloride cells on the gill surface could be confirmed. In Oligoneuriidae, however, this may be a significant function of the voluminous gill tufts, as they are densely covered with coniform and bulbiform chloride cells. The main function of accessory gills in general is probably indeed to support respiration.

5 Conclusions

Recent phylogenetic studies (OGDEN et al. 2009) support a sistergroup relationship of Nesameletidae + Rallidentidae, but do not support a monophyletic Eusetisura. Although Siphluriscidae, Baetidae, and Isonychiidae in this phylogeny represent three basal branches of Ephemeroptera, the most parsimonious assumption would still be an independent acquisition of accessory gills in these taxa. This is also supported by the different position and fine structure of maxillary gills in Siphlonuroidea and Setisura. The main function of accessory gills may indeed be aiding in respiration, and a role in osmoregulation can be assumed for Oligoneuriidae.

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Neotropical Cicadellinae (Hemiptera: Cicadellidae) in the Staatliches Museum für Naturkunde Stuttgart

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Abstract

In this paper, 87 species of leafhoppers (Hemiptera: Cicadellidae) of the subfamily Cicadellinae are reported from previously undetermined material of the Staatliches Museum für Naturkunde Stuttgart, Germany. *Agrosoma placetis* Medler, 1960 is recorded for the first time from Belize. Specimens were determined from the following countries: Argentina, Belize, Brazil, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Mexico, Paraguay, Peru, and Venezuela.

Key words: Insecta, Hemiptera, Cicadellidae, Cicadellinae, Taxonomy.

Zusammenfassung

In vorliegender Arbeit werden 87 Zwergzikadenarten (Hemiptera: Cicadellidae) der Unterfamilie der Blattzikaden (Cicadellinae) aus bisher unbestimmtem Material des Museums für Naturkunde Stuttgart, Deutschland, mit ihren Funddaten aufgelistet. Für *Agrosoma placetis* Medler, 1960 erfolgt der erstmalige Nachweis für Belize. Es wurde insgesamt Material aus Argentinien, Belize, Brasilien, Costa Rica, der Dominikanischen Republik, Ecuador, Guatemala, Kolumbien, Mexiko, Paraguay, Peru und Venezuela untersucht und bestimmt.

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1 Introduction

Linnavuori & Heller (1961) were the first who studied the collection of leafhoppers in the Staatliches Museum für Naturkunde Stuttgart (SMNS). Their paper treated species of Agalliinae, Deltocephalinae, Iassinae, Neobalinae, Xestocephalinae, Neocoelidiinae and Hecalinae, including 20 new species of these subfamilies. Since then, nobody had studied the neotropical material of Cicadellidae in the museum.

In the present paper, the data of 87 species of the subfamily Cicadellinae are reported, based on the holdings of previously undetermined Cicadellidae deposited in the collections of the Stuttgart museum. All specimens (869) were determined by the author. The records include data from the following countries: Argentina, Belize, Brazil, Colombia, Costa Rica, the Dominican Republic, Ecuador, Guatemala, Mexico, Paraguay, Peru, and Venezuela. The species *Agrosoma placetis* Medler, 1960 is reported for the first time from Belize.

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2 Methods

The preparations of the male genitalia for the identification to species level were made placing the abdomen in a 10% solution of heated KOH for a short time, and subsequently washing it in distilled water to remove the remaining alkali.

The following literature was used for the identifications: Lozada & León (1996), Medler (1960, 1963), McKamey (2007), Takiya & Cavichioli (2004), and Young (1968, 1977).

Translations of several German expressions and the actual spelling of some localities are given in square brackets.

3 Results

3.1 Cicadellini

Agrosoma placetis Medler, 1960

Costa Rica: 4 ♀♀, Talamanca, 6.V.1986, leg. M. & V. Cajek. – **Belize**: 1 ♂, 2 ♀♀, San Ignatio, 6.II.1994, leg. C. Schmid-Egger.

Distribution: Costa Rica, Guatemala, Nicaragua, Panama.

Agrosoma proxima (Signoret, 1853)

Costa Rica: 1 ♂, Talamanca, 9.V.1986, leg. M. & V. Cajek.

Distribution: Guatemala, Honduras, Costa Rica.

Amblyscarta invenusta Young, 1977

Paraguay: 1 ♂, Dep. San Pedro, Umg. [=environs] Vaca Jhu, Estancia Triangulo, Ruta 10, km 252, 25.–28.II.1993, leg. F. Bretzendorfer.

Distribution: Colombia, Guyana, French Guiana, Brazil, Paraguay, Argentina.

Amblyscarta obscura Young, 1977

Peru: 1 ♂, Dep. Madre de Dios, Puerto Maldonado, 12°37'S 69°11'W, ca. 250 m, Rio Madre de Dios, 2 h abwärts [=downstream], Privatreservat Ecoamazonia Lodge, 22.–30.XI.1997, leg. B. Kreusel.

Distribution: Brazil, Peru.

Amblyscarta opulenta (Walker, 1851)

Colombia: 1 ♂, Bogotá, 60 km E near Monteredondo [Monterredondo], 1340 m, 18.X.1961, leg. R. & H. Schahl; 1 ♂, same data except 30.X.1961; 1 ♂, same data except 12.X.1961; 1 ♂, same data except 3.XII.1961.

Distribution: Venezuela, Colombia, Ecuador, Peru.

Amblyscartidia albofasciata (Walker, 1851)

Brazil: 1 ♂, 2 ♀♀, 1 specimen without abdomen, Rio de Janeiro, 1884, Beutenmüller.

Distribution: Brazil.

Amblyscartidia elegantissima (Blanchard, 1840)

Brazil: 1 ♀, Rio de Janeiro, XI.1919, Müller.

Distribution: Brazil.

Apogonalia staali (Signoret, 1855)

Costa Rica: 12 ♂♂, 19 ♀♀, Peninsula Nikoya, Montezuma, 100 m, Bachufer [=edge of brook], an Gräsern u. Strauchwerk [=on grass and shrubs], 18.II.1986, leg. M. & V. Cajek.

Distribution: Mexico, Guatemala, Honduras, Nicaragua, Costa Rica, El Salvador.

Apogonalia woodruffi Young, 1977

Mexico: 1 ♂, 1 ♀, Mexico, 1859, Dr. Hiller.

Distribution: Mexico, Guatemala.

Borogonalia crinata Young, 1977

Peru: 1 ♂, 2 ♀♀, Prov. Cuzco, Machu Picchu, 4.5 km SE Phuyupatamarka, 3600 m, 1.IV.1974, leg. H. Kostenbader; 2 ♂♂, 1 ♀, same data except 2.7 km SE Winay Wayna, 2600 m, 2.IV.1974; 1 ♀, Prov. Cuzco, Machu Picchu, 2400 m, 4.IV.1974, leg. H. Kostenbader.

Distribution: Peru.

Borogonalia impressifrons (Signoret, 1854)

Argentina: 1 ♂, 6 ♀♀, Tucuman, San Pedro de Colalao, II.1950. – **Colombia**: 5 ♂♂, 8 ♀♀, 1 specimen without abdomen, Antioquia, Fredonia, 2000 m, 19.VIII.1976, leg. P. A. Schneble; 3 ♂♂, 8 ♀♀, Bogotá-Guadalupe, 3500 m, 8.XII.1962, leg. R. & H. Schahl; 1 ♂, 1 ♀, Antioquia, Caldas, "Salinas", 1700 m, 24.III.1964, leg. P. A. Schneble.

Distribution: Venezuela, Colombia, Ecuador, Bolivia, Brazil, Peru, Argentina.

Bucephalogonia xanthophis (Berg, 1879)

Brazil: 1 ♂, Rio Grande do Sul, Panambi, 450 m, an Strauchwerk [=on shrubs], 6.XII.1970, leg. H. Schaal; 1 ♀, same data except Licht b. Tankstelle [=at light near gas station] and 14.XII.1970; 1 ♀, same data except Brombeer [=on blackberry] and 22.XI.1970; 1 ♂, same data except an Maisblättern [=on leaves of maize] and 14.XII.1970; 4 ♂♂, 1 ♀, same data except 14.XI.1971. – **Argentina**: 1 ♂, Prov. Catamarca, S Santa Maria, Punta de Balasto, 3.I.1991, leg. T. Osten; 3 ♂♂, 2 ♀♀, Prov. Salta, 10 km S Rosario de Lerma, 1200 m, 14.XII.1990, leg. T. Osten; 5 ♂♂, 2 ♀♀, Prov. Salta, Cabra Corral, Sumalao, 1200 m, 15.XII.1990, leg. T. Osten; 2 ♀♀, Salta, 26.X.1976, leg. K. W. Harde; 1 specimen without abdomen, Tucuman, San Pedro de Colalao, II.1950; 1 ♂, 1 specimen without abdomen, T. N. Formosa, loc. Grau Guardia, II.1953. – **Paraguay**: 22 ♂♂, 11 ♀♀, 2 specimens without abdomen, Paso Yobayi, 3.XI.1951.

Distribution: Argentina, Bolivia, Brazil, Paraguay.

Catagonalia conjunctula (Osborn, 1926)

Peru: 1 ♂, Madre de Dios, Zona Reservada Tambopata-Candamo, vic. Explorer's Inn, 12°51'S 69°18'W, 250 m, LF. [=at light], 12.–16.XI.1997. leg. C. Häuser & B. Kreusel.

Distribution: Bolivia, Brazil, Ecuador, Peru, Paraguay.

Cephalogonalia blancasi Lozada, 1996

Peru: 1 ♂, Dep. Junín, San Ramón, 11°08'S 75°18'W, ca. 1000–1200 m, ca. 15 km NW Richtung [=direction] Oxabamba, Hacienda La Mosela, 27.XII.1997, leg. B. Kreusel.

Distribution: Peru.

Cephalogonalia flabellula (Jacobi, 1905)

Peru: 5 ♂♂, 2 ♀♀, Prov. Cuzco, Machu Picchu, 4.5 km SE Phuyupatamarka, 3600 m, 1.IV.1974, leg. H. Kostenbader.

Distribution: Peru, Bolivia.

Chlorogonalia coeruleovittata (Signoret, 1855)

Colombia: 1 ♂, 1 ♀, 1 specimen without abdomen, Antioquia, Guarne, 2100 m, 13.VII.1973, leg. P. A. Schneble; 4 ♂♂, 1 ♀, Antioquia, Amago, Sinifana, 1100 m, 18.II.1964, leg. P. A.

SCHNEBLE; 7 ♂♂, 1 specimen without abdomen, Antioquia, Fredonia, 2000 m, 19.VIII.1976, leg. P. A. SCHNEBLE; 7 ♂♂, Medellin, La Estrella, 1720 m, 30.I.1974, leg. P. A. SCHNEBLE; 2 ♂♂, same data except 1700–1900 m and 12.II.1976; 8 ♂♂, 3 ♀♀, 1 specimen without abdomen, Antioquia, La Estrella, 2100 m, 14.VIII.1976, leg. P. A. SCHNEBLE; 6 ♂♂, Antioquia, Caldas, "Salinas", 1700 m, 24.III.1964, leg. P. A. SCHNEBLE. – **Mexico**: 5 ♂♂, 3 ♀♀, Tapachula, 3.5 km S, 173 m, 15.II.–5.III.1974, leg. G. & M. KÖHLER; 4 ♂♂, 2 ♀♀, 2 specimens without abdomen, Guerrero, Tasco, Hacienda San Francisco, 1700 m, 1.–13.II.1972, leg. G. & M. KÖHLER.

Distribution: Mexico, Guatemala, Costa Rica, El Salvador, Venezuela, Colombia, Brazil, Honduras, Nicaragua, Peru.

Coronigonalia spectanda (Fowler, 1900)

Costa Rica: 1 ♂, 2 ♀♀, Puerto Viejo-Talamanca, 100 m, 1.–16.II.1986, leg. M. & V. CAJEK; 2 ♀♀, Puerto Viejo, a. d. Str. n. [= at the road to] Limon, 18.IV.1986, leg. M. & V. CAJEK.

Distribution: Costa Rica, Panama.

Diedrocephala bimaculata (Gmelin, 1789)

Paraguay: 1 ♀, Dep. San Pedro, Umg. [= environs] Vaca Jhu, Lux [= at light], 20.–24.II.1993, leg. K. HOHENSTEIN; 6 ♂♂, 3 ♀♀, 2 specimens without abdomen, Paso Yobayi, 3.XI.1951. – **Argentina**: 2 ♀♀, Santa Ana, XII.1952.

Distribution: Mexico, Honduras, El Salvador, Costa Rica, Panama, Colombia, Venezuela, Guyana, Suriname, French Guiana, Brazil, Paraguay, Argentina, Peru, Bolivia.

Dilobopterus auctulus (Jacobi, 1905)

Colombia: 1 ♂, Cundinamarca, Monterredondo, 1500 m, 24.II.1975, leg. P. A. SCHNEBLE.

Distribution: Colombia, Peru, Bolivia.

Dilobopterus dispar (Germar, 1821)

Brazil: 2 ♂♂, Rio Grande do Sul, Panambi, 450 m, an Sonnenblumen [= on sunflowers], 27.I.1971, leg. H. SCHAAL.

Distribution: Bolivia, Brazil, Uruguay, Argentina.

Dilobopterus exaltatus (Fabricius, 1803)

Peru: 1 ♂, Hacienda Mascoitania, Urwald [= virgin forest], 10.–12.IX.1957, Anden-Expedition.

Distribution: French Guiana, Guyana, Peru, Bolivia, Brazil.

Erythrogonia imitatricula (Jacobi, 1905)

Peru: 2 ♂♂, 3 ♀♀, Prov. Cuzco, Machu Picchu, 2400 m, 4.IV.1974, leg. H. KOSTENBADER.

Distribution: Peru, Bolivia.

Erythrogonia partita Melichar, 1926

Costa Rica: 1 ♂, 1 ♀, Peninsula Nikoya, Montezuma, 100 m, Bachufer [= edge of brook], an Gräsern u. Strauchwerk [= on grass and shrubs], 18.II.1986, leg. M. & V. CAJEK.

Distribution: Mexico, Costa Rica.

Erythrogonia quadriplagiata (Walker, 1851)

Colombia: 1 ♂, Valle, Cali, 1000 m, 14.III.1979, leg. P. A. SCHNEBLE.

Distribution: Costa Rica, Panama, British West Indies, Colombia, Venezuela.

Exogonia assimilis (Signoret, 1853)

Brazil: 1 ♂, Nova Teutonia, 27°11'S 52°23'W, 300–500 m, X.1969, leg. F. PLAUMANN.

Distribution: Brazil.

Ferrariana trivittata (Signoret, 1854)

Paraguay: 1 ♂, 1 ♀, 1 specimen without abdomen, San Pedro, W Vacajhú [= Vaca Jhu], Estancia Triangulo, 24°35–40'S 56°35–45'W, 180 m, 1.–6.XI.1995, leg. F. BRETZENDORFER & C. HÄUSER; 2 ♀♀, same data except 12.–15.XI.1995; 1 ♂, 2 ♀♀, Dep. San Pedro, Umg. [= environs] Vaca Jhu, Estancia Triangulo, Ruta 10, km 252, 20.–24.II.1993, leg. F. BRETZENDORFER; 1 ♂, 2 ♀♀, same data except 25.–28.II.1993. – **Brazil**: 1 ♂, Santa Catarina, Nova Teutonia, II.1972, leg. F. PLAUMANN; 2 ♂♂, 1 ♀, Rio Grande do Sul, Panambi, im Xaxim, 18.I.1974, leg. H. SCHAAL.

Distribution: Brazil, Costa Rica, Panama, Colombia, Peru, Bolivia, Paraguay, Argentina.

Fusigonalia metaensis Young, 1977

Colombia: 5 ♂♂, 3 ♀♀, Cundinamarca, Monterredondo, 1500 m, 24.II.1975, leg. P. A. SCHNEBLE.

Distribution: Colombia.

Graphocephala redacta (Fowler, 1900)

Venezuela: 2 ♂♂, 1 ♀, Caracas, östl. Stadtrand [= eastern periphery], 870 m, 8.XI.1975, leg. P. KNECHT.

Distribution: Mexico, Guatemala, Costa Rica, Panama, Venezuela, French Guiana.

Hortensia similis (Walker, 1851)

Peru: 1 ♂, Dep. Junín, San Ramón, 11°08'S 75°18'W, ca. 800–900 m, ca. 10 km SW, bewaldetes Bachtal zw. Plantagen [= forested stream valley between plantations], 23.XII.1997, leg. B. KREUSEL; 1 ♀, Prov. Cuzco, Machu Picchu, 2700 m, 22.III.1973, leg. H. KOSTENBADER. – **Colombia**: 1 specimen without abdomen, Antioquia, Guarne, 2100 m, 13.VII.1973, leg. P. A. SCHNEBLE; 4 ♂♂, 5 ♀♀, Antioquia, Caldas, "Salinas", 1700 m, 24.III.1964, leg. P. A. SCHNEBLE; 5 ♂♂, 1 ♀, Cali, 1200 m, 1.IV.1964, leg. P. A. SCHNEBLE; 34 ♂♂, 13 ♀♀, 1 specimen without abdomen, Antioquia, Fredonia, 2000 m, 19.VIII.1976, leg. P. A. SCHNEBLE; 2 ♀♀, Medellin, La Estrella, 1720 m, 30.I.1974, leg. P. A. SCHNEBLE; 2 ♂♂, Antioquia, La Estrella, 2100 m, 14.VIII.1976, leg. P. A. SCHNEBLE; 1 ♂, Antioquia, El Santuario, 2100 m, 20.IV.1975, leg. P. A. SCHNEBLE. – **Argentina**: 1 ♂, T. N. Formosa, loc. Grau Guardia, IX.1952. – **Costa Rica**: 2 ♂♂, 1 ♀, Peninsula Nikoya, Montezuma, 100 m, Bachufer [= edge of brook], an Gräsern u. Strauchwerk [= on grass and shrubs], 18.II.1986, leg. M. & V. CAJEK. – **Ecuador**: 1 ♀, Pichincha, El Unión de Toachi, 0°18'S 78°57'W, 850–900 m, L. F. [= at light], 14.XII.1999, leg. D. BARTSCH & C. HÄUSER. – **Brazil**: 2 ♀♀, Santa Catarina, Nova Teutonia, 8.–25.III.1978, leg. F. PLAUMANN; 1 ♀, Panambi, I.1976, leg. H. SCHAAL; 12 ♂♂, 12 ♀♀, Rio Grande do Sul, Panambi, im

Xaxim, 18.I.1974, leg. H. SCHAAL. – **Venezuela**: 4 ♂♂, 4 ♀♀, E Caracas, 870 m, 14.XII.1975, leg. P. KNECHT; 7 ♂♂, 9 ♀♀, 2 specimens without abdomen, E Caracas, 960 m, 13.XI.1975, leg. P. KNECHT. – **Paraguay**: 1 ♂, Distr. San Pietro [Dep. San Pedro], Vaca Jhu, 20.IV.1987, leg. K. HOHENSTEIN; 1 ♀, Dep. San Pedro, Umg. [=environs] Vaca Jhu, Estancia Triangulo, Ruta 10, km 252, 25.–28.II.1993, leg. F. BRETZENDORFER; 2 ♂♂, 1 ♀, same data except Ruta 5 and 30.IX.–9.X.1988. – **Dominican Republic**: 1 ♂, 1 ♀, Puerto Plata, Brachland [=waste land] Punta, a. nied. Pflanz. [=on lower plants], 13.–24.III.1991, leg. L. RAPP. – **Mexico**: 1 ♂, Tapachula, 3.5 km S, 173 m, 15.II.–5.III.1974, leg. G. & M. KÖHLER.

Distribution: USA, Mexico, Central and South America, West Indies.

Iragua diversa (Signoret, 1855)

Peru: 1 ♂, Madre de Dios, Zona Reservada Tambopata-Candamo, vic. Explorer's Inn, 12°51'S 69°18'W, 250 m, LF. [=at light], 12.–16.XI.1997. leg. C. HÄUSER & B. KREUSEL.

Distribution: French Guiana, Brazil, Peru, Bolivia, Colombia.

Jakrama eureta Young, 1977

Peru: 1 ♂, Madre de Dios, Zona Reservada Tambopata-Candamo, vic. Explorer's Inn, 12°51'S 69°18'W, 250 m, LF. [=at light], 12.–16.XI.1997, leg. C. HÄUSER & B. KREUSEL.

Distribution: Peru, Colombia.

Jozima leucopa (Walker, 1858)
[in the sense of YOUNG (1977)]

Peru: 2 ♂♂, Madre de Dios, Zona Reservada Tambopata-Candamo, vic. Explorer's Inn, 12°51'S 69°18'W, 250 m, LF. [=at light], 12.–16.XI.1997, leg. C. HÄUSER & B. KREUSEL.

Distribution: Peru, Bolivia.

Ladoffa ignota (Walker, 1851)

Costa Rica: 2 ♂♂, 2 ♀♀, Peninsula Nikoya, Montezuma, 100 m, Bachufer [=edge of brook], an Gräsern u. Strauchwerk [=on grass and shrubs], 18.II.1986, leg. M. & V. CAJEK; 1 ♂, 1 ♀, Puerto Viejo, a. d. Str. n. [=at the road to] Limon, 18.IV.1986, leg. M. & V. CAJEK.

Distribution: Costa Rica, Panama, Colombia (mainland and Gorgona Island), Guyana, Belize.

Ladoffa sannionis Young, 1977

Costa Rica: 2 ♂♂, 7 ♀♀, Peninsula Nikoya, Montezuma, 100 m, Bachufer [=edge of brook], an Gräsern u. Strauchwerk [=on grass and shrubs], 18.II.1986, leg. M. & V. CAJEK; 1 ♀, Suretka-Talamanca, 6.V.1986, leg. M. & V. CAJEK.

Distribution: Mexico, Central America, Colombia, Venezuela, Ecuador, Guyana, Suriname.

Macugonalia cavifrons (Stål, 1862)

Brazil: 1 ♀, Rio Grande do Sul, Panambi, 17.XI.1971, leg. H. SCHAAL; 2 ♀♀, same data except 14.XI.1971; 1 ♀, same data except 450 m and 28.XI.1971; 4 ♂♂, 1 ♀, same data except im Xaxim and 18.I.1974; 1 ♀, same data except 1.XII.1971 and Lichtfang am Haus [=at light near house]; 3 ♀♀, same data except 29.XI.1971 and an Sonnenblumen [=on sunflowers]; 1 ♀, Rio Grande do Sul, Herval Seco, an Strauchwerk i. Wald [=on shrubs in the forest], 6.XII.1971, leg. H. SCHAAL. – **Colombia**: 1 ♀, Monterredondo, 1200 m, 14.II.1961, leg. P. A. SCHNEBLE; 1 ♀, Bogotá, ca. 60 km [E] near Monterredondo, 1400 m, 24.VI.1973, leg. P. A. SCHNEBLE. – **Paraguay**: 3 ♀♀, Distr. San Pietro [Dep. San Pedro], Vaca Jhu, 20.IV.1987, leg. K. HOHENSTEIN; 7 ♂♂, 10 ♀♀, Asunción, Hotelgarten "Frauenhilfe", 18.II.1993, leg. F. BRETZENDORFER; 2 ♀♀, Dep. San Pedro, Colonia Friesland, aus Druschabfall von Sojabohnen [=threshing remains of soybeans], 25.II.1993, leg. F. BRETZENDORFER.

Distribution: Venezuela, Colombia, Peru, Bolivia, Brazil, Paraguay, Argentina.

Macugonalia leucomelas (Walker, 1851)

Brazil: 1 ♀, Rio Grande do Sul, Panambi, 450 m, Lichtfang [=at light], 1.XII.1971, leg. H. SCHAAL; 1 ♂, 4 ♀♀, 1 specimen without abdomen, same data except 26.XI.1971 and an Strauchwerk. i. G. [=on shrubs]; 6 ♂♂, 6 ♀♀, same data except 14.XI.1971; 1 ♀, same data except 25.XI.1971 and an Sonnenblumen [=on sunflowers]; 1 ♂, same data except 14.IV.1971 and an *Chrysanthemum*; 1 ♂, same data except 24.IV.1971 and an *Rubus*. – **Paraguay**: 1 ♂, 5 ♀♀, Dep. San Pedro, Umg. [=environs] Vaca Jhu, Estancia Triangulo, Wald bei Korral [=forest near corral], 1.–6.III.1993, leg. F. BRETZENDORFER; 1 ♂, 1 ♀, same data except 20.–24.II.1993; 1 ♂, 3 ♀♀, same data except an Rosen [=on roses]; 1 ♂, San Pedro, W Vacajhú [=Vaca Jhu], Estancia Triangulo, 24°35–40'S 56°35–45'W, 180 m, 1.–6.XI.1995, leg. F. BRETZENDORFER & C. HÄUSER; 12 ♂♂, 5 ♀♀, 1 specimen without abdomen, Paso Yobayi, 3.XI.1951. – **Argentina**: 1 ♂, Santa Ana, XII.1952.

Distribution: Bolivia, Brazil, Paraguay, Argentina, Venezuela.

Macugonalia limitatula Young, 1977

Colombia: 1 ♂, Cundinamarca, Monterredondo, 1500 m, 24.II.1975, leg. P. A. SCHNEBLE.

Distribution: Colombia.

Macugonalia moesta (Fabricius, 1803)

Colombia: 1 ♀, Bogotá, ca. 60 km E near Monteredondo [Monterredondo], 1400 m, 3.XII.1961, leg. R. & H. SCHAHL.

Distribution: Guyana, Suriname, French Guiana, Brazil, Ecuador, Peru, Bolivia, Colombia.

Macugonalia sobrina (Stål, 1862)

Brazil: 3 ♂♂, 2 ♀♀, Rio Grande do Sul, Panambi, im Xaxim, 18.I.1974, leg. H. SCHAAL.

Distribution: Brazil, Argentina.

Macugonalia umbrosa Young, 1977

Colombia: 1 ♂, Antioquia, Fredonia, 2000 m, 19.VIII.1976, leg. P. A. SCHNEBLE; 1 ♂, Bogotá, ca. 60 km [E] near Monterredondo, 1400 m, 24.VI.1973, leg. P. A. SCHNEBLE; 3 ♂♂, 1 ♀, Cundinamarca, Monterredondo, 1500 m, 24.II.1975, leg. P. A. SCHNEBLE.

Distribution: Colombia.

Macunolla ventralis (Signoret, 1854)

Costa Rica: 2 ♀♀, Talamanca, 8.V.1986, leg. M. & V. CAJEK; 1 ♂, Suretka-Talamanca, an Gräsern u. a. nied. Pflanzen [=on grass and other lower plants], 6.V.1986, leg. M. & V. CAJEK; 1 ♀, Peninsula Nikoya, Montezuma, 100 m, Bachufer [=edge of brook], an Gräsern u. Strauchwerk [=on grass and shrubs], 18.II.1986, leg. M. & V. CAJEK.

Distribution: Mexico, Belize, Guatemala to Colombia, Ecuador.

Mareja anceps (Fowler, 1900)

Costa Rica: 1 ♀, Peninsula Nikoya, Montezuma, Buchurici, 100 m, Bachufer [=edge of brook], an Gräsern u. Strauchwerk [=on grass and shrubs], 18.II.1986, leg. M. & V. CAJEK.

Distribution: Costa Rica, Panama, Colombia, Venezuela.

Microgoniella tristicula (Melichar, 1926)

Colombia: 1 ♂, 1 ♀, Medellin, La Estrella, 1720 m, Seminar, an Geranien [=on *Geranium*], 10.VI.1976, leg. P. A. SCHNEBLE; 1 ♂, same data except Augustin and 15.III.1974.

Distribution: Colombia.

Onega krameri Takiya & Cavichioli, 2004

Ecuador: 21 ♂♂, 4 ♀♀, Cotopaxi, San Francisco de las Pampas, Otonga-Reserve, 0°25'S 79°00'W, 1800–2000 m, L. F. [=at light], 15.XII.1999, leg. D. BARTSCH & C. HÄUSER.

Distribution: Venezuela, Ecuador, Peru, Bolivia, Brazil.

Onega orphne Takiya & Cavichioli, 2004

Ecuador: 6 ♂♂, 1 ♀, Pichincha, El Unión de Toachi, 0°18'S 78°57'W, 850–900 m, L. F. [=at light], 14.XII.1999, leg. D. BARTSCH & C. HÄUSER.

Distribution: Ecuador.

Oragua discoidula (Osborn, 1926)

Brazil: 1 ♂, Rio Grande do Sul, Panambi, im Xaxim, 18.I.1974, leg. H. SCHAAL.

Distribution: Brazil, Paraguay, Argentina, Colombia.

Pachitea subflava (Walker, 1851)

Colombia: 1 ♀, Monterredondo, 1200 m, 11.–14.II.1961, leg. P. A. SCHNEBLE.

Distribution: Venezuela, Colombia.

Parathona gratiosa (Blanchard, 1840)

Brazil: 1 ♂, Rio Grande do Sul, Panambi, 450 m, an Brombeere i. G. [=on blackberry], 20.II.1972, leg. H. SCHAAL; 1 ♀, same data except 28.XI.1971; 2 ♀♀, same data except 14.XI.1971. – **Paraguay**: 1 ♂, Dep. San Pedro, Umg. [=environs] Vaca Jhu, Estancia Triangulo, Wald bei Korral [=forest near corral], 1.–6. III.1993, leg. F. BRETZENDORFER.

Distribution: Brazil, Bolivia, Paraguay, Argentina.

Paromenia falcata Young, 1977

Ecuador: 2 ♂♂, Pichincha, El Unión de Toachi, 0°18'S 78°57'W, 850–900 m, L. F. [=at light], 14.XII.1999, leg. D. BARTSCH & C. HÄUSER.

Distribution: Ecuador, Peru.

Paromenia weyrauchi Young, 1977

Peru: 1 ♂, Madre de Dios, Zona Reservada Tambopata-Candamo, vic. Explorer's Inn, 12°51'S 69°18'W, 250 m, LF. [=at light], 12.–16.XI.1997. leg. C. HÄUSER & B. KREUSEL.

Distribution: Peru.

Pawiloma fulpae Young, 1977

Peru: 1 ♂, Prov. Cuzco, Machu Picchu, 2.7 km SE Winay Wayna, 2600 m, 2.IV.1974, leg. H. KOSTENBADER; 1 ♂, 1 ♀, Prov. Cuzco, Machu Picchu, 2700 m, 22.III.1973, leg. H. KOSTENBADER.

Distribution: Peru.

Pawiloma victima (Germar, 1821)

Argentina: 3 ♂♂, 3 ♀♀, near Rosario, 19.V.1978, leg. K. HOHENSTEIN.

Distribution: Brazil, Paraguay, Argentina.

Plesiommata mollicella (Fowler, 1900)

Ecuador: 6 ♂♂, 7 ♀♀, Pichincha, El Unión de Toachi, 0°18'S 78°57'W, 850–900 m, L. F. [=at light], 14.XII.1999, leg. D. BARTSCH & C. HÄUSER; 2 ♂♂, Cotopaxi, San Francisco de las Pampas, Otonga-Reserve, 0°25'S 79°00'W, 1800–2000 m, L. F. [=at light], 15.XII.1999, leg. D. BARTSCH & C. HÄUSER. – **Brazil**: 1 ♂, Rio Grande do Sul, Panambi, 450 m, Lichtfang [=at light], 15.II.1971, leg. H. SCHAAL; 1 ♀, same data except 10.III.1970; 2 ♀♀, same data except 24.III.1971 and Lichtfang am Haus [=at light near house].

Distribution: Mexico, Belize, Colombia, Venezuela, French Guiana, Ecuador, Bolivia, Paraguay, Brazil, Argentina, Nicaragua, Guatemala, Costa Rica, Panama.

Punahuana brunneatula (Osborn, 1926)

Peru: 1 ♂, 3 ♀♀, Prov. Cuzco, Machu Picchu, 2.7 km SE Winay Wayna, 2600 m, 2.IV.1974, leg. H. KOSTENBADER; 1 ♂, 2 ♀♀, same data except 4.IV.1974.

Distribution: Peru, Bolivia.

Scopogonalia subolivacea (Stål, 1862)

Paraguay: 4 ♂♂, 6 ♀♀, Paso Yobayi, 3.XI.1951; 1 ♀, same data except "war parasitiert" [=was parasitized].

Distribution: Peru, Bolivia, Brazil, Paraguay, Argentina.

Scoposcartula limitata (Signoret, 1853)

Brazil: 1 ♂, 1 ♀, Rio Grande do Sul, Panambi, 14.XI.1971, leg. H. SCHAAL.

Distribution: Brazil, Paraguay, Argentina.

Sibovia compta (Fowler, 1900)

Mexico: 3 ♂♂, 5 ♀♀, Guerrero, Tasco, Hacienda San Francisco, 1700 m, 1.–13.II.1972, leg. G. & M. Köhler.

Distribution: USA, Mexico, Guatemala, El Salvador, Costa Rica.

Sibovia festana Young, 1977

Colombia: 2 ♂♂, 1 ♀, Antioquia, Fredonia, 2000 m, 19.VIII.1976, leg. P. A. Schneble; 3 ♂♂, Cundinamarca, Monterredondo, 1500 m, 24.II.1975, leg. P. A. Schneble.

Distribution: Colombia, Venezuela, Ecuador, Peru, Mexico.

Sibovia sagata (Signoret, 1854)

Brazil: 2 ♀♀, Rio Grande do Sul, Panambi, 450 m, Lichtfang am Haus [=at light near house], XII.1971, leg. H. Schaal; 4 ♂♂, 3 ♀♀, same data except 26.XI.1971 and an Strauchwerk [=on shrubs].

Distribution: Brazil, Argentina, Bolivia.

Sibovia taeniatifrons (Schmidt, 1928)

Colombia: 2 ♀♀, Cundinamarca, Monterredondo, 1500 m, 24.II.1975, leg. P. A. Schneble.

Distribution: Colombia, Ecuador, Peru.

Sonesimia dimidiata Young, 1977

Brazil: 9 ♂♂, 12 ♀♀, Rio Grande do Sul, Sinimbu, an Sonnenblumen [=on sunflowers], 15.II.1971, leg. H. Schaal; 1 ♂, Rio Grande do Sul, Panambi, an *Rubus*, 10.III.1971, leg. H. Schaal.

Distribution: Argentina, Brazil.

Sonesimia grossa (Signoret, 1854)

Paraguay: 1 ♂, 1 ♀, 1 specimen without abdomen, Dep. San Pedro, Umg. [=environs] Vaca Jhu, Ruta 5, 30.IX.–9.X.1988, leg. F. Bretzendorfer; 1 ♂, 1 ♀, Distr. San Pietro [Dep. San Pedro], Vaca Ihu [Jhu], 17.IV.1987, leg. K. Hohenstein; 1 ♂, 2 ♀♀, same data except 20.IV.1987.

Distribution: Bolivia, Brazil, Paraguay, Argentina.

Soosiulus salutaris (Fowler, 1900)

Costa Rica: 1 ♀, Puerto Viejo-Talamanca, 100 m, 1.–16.II.1986, leg. M. & V. Cajek.

Distribution: Costa Rica, Panama, Nicaragua, Colombia, Peru.

Sphaeropogonia miniatula Jacobi, 1905

Peru: 1 ♀, Dep. Madre de Dios, Puerto Maldonado, 12°37'S 69°11'W, ca. 250 m, Rio Madre de Dios, 2 h abwärts [=downstream], Privatreservat Ecoamazonia Lodge, 22.–30.XI.1997, leg. B. Kreusel.

Distribution: Peru, Bolivia.

Stehlikiana obsoleta (Signoret, 1854)

Colombia: 1 ♂, 1 ♀, Cundinamarca, Monterredondo, 1500 m, 24.II.1975, leg. P. A. Schneble.

Distribution: Venezuela, Colombia.

Stephanolla rufoapicata (Fowler, 1900)

Costa Rica: 1 ♂, 1 ♀, Puerto Viejo-Talamanca, 1.–16.IV.1987, leg. M. & V. Cajek; 1 ♀, Puerto Viejo, a. d. Str. n. [=at the road to] Limon, 25.IV.1987, leg. M. & V. Cajek.

Distribution: Costa Rica, Panama.

Syncharina punctattissima (Signoret, 1854)

Brazil: 4 ♀♀, Rio Grande do Sul, Panambi, 450 m, Lichtfang [=at light], 28.III.1973, leg. H. Schaal.

Distribution: Brazil, Argentina, Bolivia.

Tettisama bisellata (Signoret, 1862)

Peru: 2 ♂♂, Dep. Madre de Dios, Puerto Maldonado, 12°37'S 69°11'W, ca. 250 m, Rio Madre de Dios, 2 h abwärts [=downstream], Privatreservat Ecoamazonia Lodge, 22.–30.XI.1997, leg. B. Kreusel; 1 ♀, Madre de Dios, Zona Reservada Tambopata-Candamo, vic. Explorer's Inn, 12°51'S 69°18'W, 250 m, LF. [=at light], 12.–16.XI.1997, leg. C. Häuser & B. Kreusel.

Distribution: Colombia, Guyana, French Guiana, Brazil, Ecuador, Peru, Bolivia, Panama, Venezuela.

Tettisama quinquemaculata (Germar, 1821)

Brazil: 1 ♂, Rio Grande do Sul, Santa Cruz do Sul, an Blättern v. Gummibaum [=on rubber tree leaves], III.1981, leg. H. Schaal.

Distribution: Suriname, Brazil, Paraguay, Argentina, Colombia.

Tlagonalia nigroguttata (Signoret, 1855)

Guatemala: 2 ♂♂, 1 ♀, Guatemala, 1884, leg. Sarg.

Distribution: Mexico, Guatemala.

Tylozygus fasciatus (Walker, 1851)

Colombia: 2 ♂♂, 4 ♀♀, 1 specimen without abdomen, Cali, 1200 m, 1.IV.1964, leg. P. A. Schneble; 1 ♀, Antioquia, Fredonia, 2000 m, 19.VIII.1976, leg. P. A. Schneble. – **Venezuela**: 6 ♂♂, 5 ♀♀, E Caracas, 870 m, 14.XII.1975, leg. P. Knecht; 8 ♂♂, 7 ♀♀, same data except 960 m and 13.XI.1975; 5 ♂♂, 11 ♀♀, same data except Östl. Stadtrand [=eastern periphery] and 8.XI.1975.

Distribution: Mexico, Central America, West Indies, Venezuela, Colombia, Ecuador, Peru, Brazil.

Tylozygus geometricus (Signoret, 1854)

Costa Rica: 2 ♂♂, 2 ♀♀, Peninsula Nikoya, Montezuma, 100 m, Bachufer [=edge of brook], an Gräsern u. Strauchwerk [=on grass and shrubs], 18.II.1986, leg. M. & V. Cajek; 1 ♂, 1 ♀, Talamanca, 8.V.1986, leg. M. & V. Cajek; 2 ♀♀, Puerto Viejo-Talamanca, 100 m, 1.–16.II.1986, leg. M. & V. Cajek. – **Mexico**: 1 ♂, Tapachula, 3.5 km S, 173 m, 15.II.–5.III.1974, leg. G. & M. Köhler.

Distribution: USA, Mexico, Central America, West Indies, Venezuela, Colombia, Peru, Brazil.

Versigonalia ruficauda (Walker, 1851)

Brazil: 1 ♂, 1 ♀, Nova Teutonia, 27°11'S 52°23'W, 300–500 m, XII.1969, leg. F. Plaumann.

Distribution: Brazil, Argentina.

3.2 Proconiini

Acrogonia virescens (Metcalf, 1949)

Paraguay: 8 ♂♂, 9 ♀♀, Asunción, Hotelgarten "Frauenhilfe", 18.II.1993, leg. F. Bretzendorfer; 1 ♀, Dep. San Pedro, Colonia Friesland, aus Druschabfall von Sojabohnen [=threshing remains of soybeans], 25.II.1993, leg. F. Bretzendorfer; 1 ♂, San Pedro, W Vacajhú [=Vaca Jhu], Estancia Triangulo, 24°35–40'S 56°35–45'W, 180 m, 7.–11.XI.1995, leg. F. Bretzendorfer & C. Häuser.

Distribution: Guyana, Peru, Brazil, Paraguay.

Aulacizes quadripunctata (Germar, 1821)

Brazil: 8 ♀♀, Rio Grande do Sul, Herval Seco, an Strauchwerk i. Wald [=on shrubs in the forest], 6.I.1971, leg. H. Schaal.

Distribution: Brazil, Argentina.

Dechacona missionum (Berg, 1879)

Argentina: 1 ♀, Prov. Salta, Parque Nacional Baritú, Finca Jaculika, 19.XII.1990, leg. T. Osten; 1 ♀, Prov. Salta, Rosario de Lerma, 25.–27.XII.1990, leg. T. Osten. – **Brazil**: 1 ♂, 2 ♀♀, Rio Grande do Sul, Panambi, 450 m, 24.XI.1971, leg. H. Schaal; 1 ♀, same data except 24.I.1971 and "an nied. Pflanzen" [=on lower plants].

Distribution: Brazil, Argentina, Paraguay, Peru.

Diestostemma blantoni Young, 1977

Ecuador: 1 ♂, Zamora-Chinchipe, Parque Nacional Podocarpus, Rio Bombuscara, National Park Station, 4°06'S 78°57'W, 1000–1200 m, L. F. (im Wald) [=at light in the forest], 5.–6. XII.1999, leg. D. Bartsch & C. Häuser.

Distribution: Panama, Belize, Ecuador, Peru, Colombia, Venezuela.

Diestostemma parvum Schmidt, 1910

Ecuador: 1 ♂, Zamora-Chinchipe, Rio San Francisco, Estación Científica San Francisco, 3°58'S 79°04'W, 1850 m, L. F. [=at light], 10.–11.XII.1999, leg. D. Bartsch & C. Häuser.

Distribution: Ecuador.

Diestostemma ptolyca Distant, 1908

Paraguay: 1 ♂, San Pedro, W Vaca Jhu, Estancia Triangulo, 24°35–40'S 56°35–45'W, ca. 180 m, Lux [=at light], 1.–6. XI.1995, leg. K. Hohenstein; 1 ♀, same locality as before, 7.–11. XI.1995, leg. F. Bretzendorfer & C. Häuser.

Distribution: Brazil, Paraguay.

Egidemia paranceps Young, 1977

Costa Rica: 1 ♂, Peninsula Nikoya, Montezuma, 100 m, Bachufer [=edge of brook], an Gräsern u. Strauchwerk [=on grass and shrubs], 18.II.1986, leg. M. & V. Cajek.

Distribution: Costa Rica, Panama.

Homoscarta ecuadoriana Schmidt, 1928

Ecuador: 1 ♂, Zamora-Chinchipe, Parque Nacional Podocarpus, Rio Bombuscara, National Park Station, 4°06'S 78°57'W, 1000–1200 m, L. F. (im Wald) [=at light in the forest], 5.–6. XII.1999, leg. D. Bartsch & C. Häuser.

Distribution: Ecuador.

Paraulacizes aurantiaca (Signoret, 1855)

Mexico: 1 ♂, Mexico, von Roser, 1872 [1872 is the year the von Roser collection came into the SMNS].

Distribution: Mexico.

Proconia marmorata (Fabricius, 1803)

Ecuador: 1 ♂, Zamora-Chinchipe, Parque Nacional Podocarpus, Rio Bombuscara, National Park Station, 4°06'S 78°57'W, 1000–1200 m, L. F. (im Wald) [=at light in the forest], 5.–6. XII.1999, leg. D. Bartsch & C. Häuser.

Distribution: Ecuador.

Pseudometopia amblardii (Signoret, 1855)

Paraguay: 2 ♂♂, Dep. San Pedro, Umg. [=environs] Vaca Jhu, Lux [=at light], 25.–28.II.1993, leg. K. Hohenstein; 1 ♂, San Pedro, W Vacajhú [=Vaca Jhu], Estancia Triangulo, 24°35–40'S 56°35–45'W, 180 m, 7.–11.XI.1995, leg. F. Bretzendorfer & C. Häuser.

Distribution: Mexico, Colombia, Ecuador, Peru, Bolivia, Brazil, Paraguay, Argentina.

Tapajosa spinata Young, 1968

Venezuela: 1 ♂, 300 km E Caracas, Küste [=coast], 12.VIII.1975, leg. P. Knecht.

Distribution: Venezuela, Ecuador.

Tretogonia cribrata Melichar, 1926

Peru: 4 ♂♂, 3 ♀♀, Dep. Madre de Dios, Puerto Maldonado, 12°37'S 69°11'W, ca. 250 m, Rio Madre de Dios, 2 h abwärts [=downstream], Privatreservat Ecoamazonia Lodge, 22.–30. XI.1997, leg. B. Kreusel; 7 ♂♂, 8 ♀♀, Madre de Dios, Zona Reservada Tambopata-Candamo, vic. Explorer's Inn, 12°51'S 69°18'W, 250 m, LF. [=at light], 12.–16.XI.1997, leg. C. Häuser & B. Kreusel.

Distribution: Brazil, French Guiana, Peru, Bolivia.

Tretogonia notatifrons Melichar, 1926

Argentina: 5 ♂♂, 3 ♀♀, T. N. Formosa, loc. Grau Guardia, II.1953; 2 ♂♂, 4 ♀♀, same data except II.1952. – **Paraguay**: 3 ♂♂, 1 ♀, Dep. San Pedro, Umg. [=environs] Vaca Jhu, Estancia Triangulo, Ruta 10, km 252, Lux [=at light], 25.–28.II.1993, leg. K. Hohenstein; 1 ♂, 1 ♀, San Pedro, W Vacajhú [=Vaca Jhu], Estancia Triangulo, 24°35–40'S 56°35–45'W, 180 m, 7.–11.XI.1995, leg. F. Bretzendorfer & C. Häuser; 1 ♂, 2 ♀♀, San Pedro, W Vaca Jhu, Estancia Triangulo, 24°35–40'S 56°35–45'W, ca. 180 m, Lux [=at light], 1.–6.XI.1995, leg. K. Hohenstein; 3 ♀♀, same data except 7.–11.XI.1995; 1 ♂, same data except 1.–6.III.1993.

Distribution: Brazil, Suriname, French Guiana, Ecuador, Bolivia, Paraguay, Argentina.

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New species of the genera *Lebia* Latreille and *Aristolebia* Bates from Indonesia (Coleoptera: Carabidae: Lebiini)[1]

MARTIN BAEHR

Abstract

A new species of the *Lebia karenia*-group sensu BAEHR and three new species of the genus *Aristolebia* Bates are described from Indonesia: *Lebia halmaherae* **n. sp.** from Halmahera, *Aristolebia apicalis* **n. sp.** from Sumatra, and *A. oculata* **n. sp.** and *A. triramosa* **n. sp.** from Sulawesi. *Lebia halmaherae* shows strong affinities to *L. darlingtoniana* Baehr from New Guinea and Sulawesi concerning body shape, colour pattern of pronotum and elytra, and structure of the aedeagus. The new species of *Aristolebia* belong to the *mucronata*-group which includes large species with conspicuously patterned elytra. *Lebia halmaherae* is added to a revised key to the Australian and Papuan species of the *Lebia karenia*-group. For the genus *Aristolebia* a key to all described species is provided.

K e y w o r d s : Coleoptera, Carabidae, *Lebia*, *Aristolebia*, new species, Indonesia.

Zusammenfassung

Eine neue Art aus der *Lebia karenia*-Gruppe sensu BAEHR und drei neue Arten der Gattung *Aristolebia* Bates aus Indonesien werden beschrieben: *Lebia halmaherae* **n. sp.** von Halmahera, *Aristolebia apicalis* **n. sp.** von Sumatra, und *A. oculata* **n. sp.** und *A. triramosa* **n. sp.** von Sulawesi. In Körperform, Färbung und Zeichnung von Pronotum und Elytren, sowie im Bau des Aedeagus ist *Lebia halmaherae* der *L. darlingtoniana* Baehr von Neuguinea und Sulawesi am ähnlichsten. Die neuen *Aristolebia*-Arten gehören zur *mucronata*-Untergruppe, welche große Arten mit auffällig gemusterten Elytren enthält. *Lebia halmaherae* wird in einen revidierten Bestimmungsschlüssel der *Lebia karenia*-Gruppe der Papua-Australischen Region eingefügt. Für die Gattung *Aristolebia* wird ein Schlüssel für alle beschriebenen Arten vorgelegt.

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1 Introduction

Several species new to science were found among samples of unidentified Indonesian carabid material, which I recently received for identification from NHM, SMNS, A. WEIGEL (Pössneck), and R. GERSTMEIER (Munich). It includes a new species of the genus *Lebia* Latreille, 1802 from Halmahera, Moluccas, and three new species of the genus *Aristolebia* Bates, 1892 from Sumatra and Sulawesi. The new species of *Lebia* belongs to the *L. karenia*-group in the sense of BAEHR (2004a); it shows strong affinities to *L. darlingtoniana* Baehr, 2004 from New Guinea. The three new species of *Aristolebia* are large, conspicuously patterned species and belong to the *mucronata*-group in the sense of BAEHR (2004b).

The *karenia*-group of the huge carabid genus *Lebia* (s. l.) includes comparatively large species that are mainly characterized, apart from their body size, by the conspicuous cruciate or quadrimaculate colour pattern of their elytra. The species of this group are widely distributed in the Oriental region, but also occur in the Australian-Papuan region. Five species from the latter area were recently described: *L. darlingtoniana* Baehr, 2004 from New Guinea and Sulawesi, *L. fallaciosa* Baehr, 2004 from

[1] 3rd supplement to "The genus *Lebia* Latreille in the Australian-Papuan Region".

New Guinea, *L. brisbanensis* Baehr, 2004 from southeastern Queensland, Australia, *L. weigeli* Baehr, 2005 from New Britain, and *L. edentata* Baehr, 2007 from northern Queensland, Australia (Baehr 2004a, 2005, 2007). These five species are very similar in their external morphology (size, shape, colour pattern, surface microsculpture), but the morphology of their aedeagi is quite different, and characteristic for each species: while in *L. darlingtoniana* and *L. brisbanensis* the internal sac bears a remarkably denticulate sclerite with a different shape, *L. fallaciosa*, *L. weigeli*, and *L. edentata* lack heavily sclerotized parts in the internal sac of the aedeagus.

The six formerly recorded species of the characteristically shaped lebiine genus *Aristolebia* are distributed from southern India to China and the Philippines, and also from New Guinea to northern Australia (Csiki 1933, Jedlicka 1963, Darlington 1968, Moore et al. 1987, Lorenz 1998, 2005). According to Darlington (1968) one species probably also occurs on or near Sulawesi. More recently, Baehr (2004b) described an additional species from Thailand and transferred the Australian *Sarothrocrepis mucronata* Sloane, 1907 from the tribe Cyclosomini to the lebiine genus *Aristolebia*. Furthermore he confirmed that *S. mucronata* is conspecific with *Aristolebia papua* Darlington, 1968 which was described from New Guinea, but also occurs in northern and north-eastern Australia.

The main differentiating characters of the genus *Aristolebia* include the angulate external angles of the elytra, the concave excision of the elytral apex, the semicircular pronotum, the presence of two preapical excisions at the inner surface of the mesotibia in males, apparently also the odd-shaped aedeagus and the likewise odd-shaped and very large genital ring, and the wide, more or less triangular, asetose gonocoxite 2 of the female. In many other characters, *Aristolebia* is similar to the large genus *Lebia* sensu lato with which *Aristolebia* is most probably closely related.

Most species of both genera from the Australian-Papuan region are available in small numbers or even as single specimens only, a fact which is most probably caused by inadequate sampling methods. However, using suitable sampling methods (e. g. fogging leaves, twigs, trunks, or the canopy of rain forest trees, or light sampling in higher strata of tropical forests), certain species of the genus *Lebia* can be collected in large numbers. This was exemplified by two species, *L. papuella*, Darlington 1968 and *L. gemina* Baehr, 2004, which were collected in New Guinea during the fogging and light trapping program carried out by O. Missa in Papua New Guinea in the nineties of last century (Baehr 2004a), as well as by large numbers of *L. australica* Baehr, 2004, recently sampled by the fogging activities of G. Monteith in open and closed forests in north-eastern Australia. Thus, application of these sampling methods in rain forests of southern Asia could probably reveal additional species and more satisfactory material of described species.

Even less is known of the habits of the species of *Aristolebia*, and this deficit may account for the very small numbers of specimens available for the described species.

The new species which are described in the present paper are known only from one or two specimens each. However, as one of the *Lebia* specimens is a male and because male genitalia are highly characteristic in almost all examined Australian-Papuan species of this genus, the species is described on the basis of these few specimens. The same applies to the three new species of *Aristolebia* considering the very characteristic colour patterns of the elytra, additional to some other external characteristics.

Acknowledgements

I am very grateful to the following persons for the kind loan and/or donation of specimens: R. Gerstmeier (Munich), C. Gillett (London), W. Schawaller (Stuttgart), and A. Weigel (Pössneck). I am also indebted to C. Huber (Bern) and P. Nagel (Basel) for reviewing the paper.

2 Methods

Methods of measurements, dissection, descriptions, and photographs follow Baehr (2004a, b). The body length was measured from apex of labrum to apex of elytra including any spines. The length of the pronotum was measured along midline.

The type material of the newly described species is stored in the following institutions:

CBM/ZSM	Working collection of Martin Baehr, Zoologische Staatssammlung, Munich
NHM	The Natural History Museum, London
SMNS	Staatliches Museum für Naturkunde, Stuttgart

3 Descriptions of new species

3.1 *Lebia halmaherae* n. sp.
(Figs. 1, 5)

Holotype (♂): Indonesia, Halmahera S, 2–3 km N Dolik, Dolik river, 0°16'49"N 127°42'40"E, 18.I.2006, leg A. Weigel, "plantage + ÜWS" (CBM/ZSM).

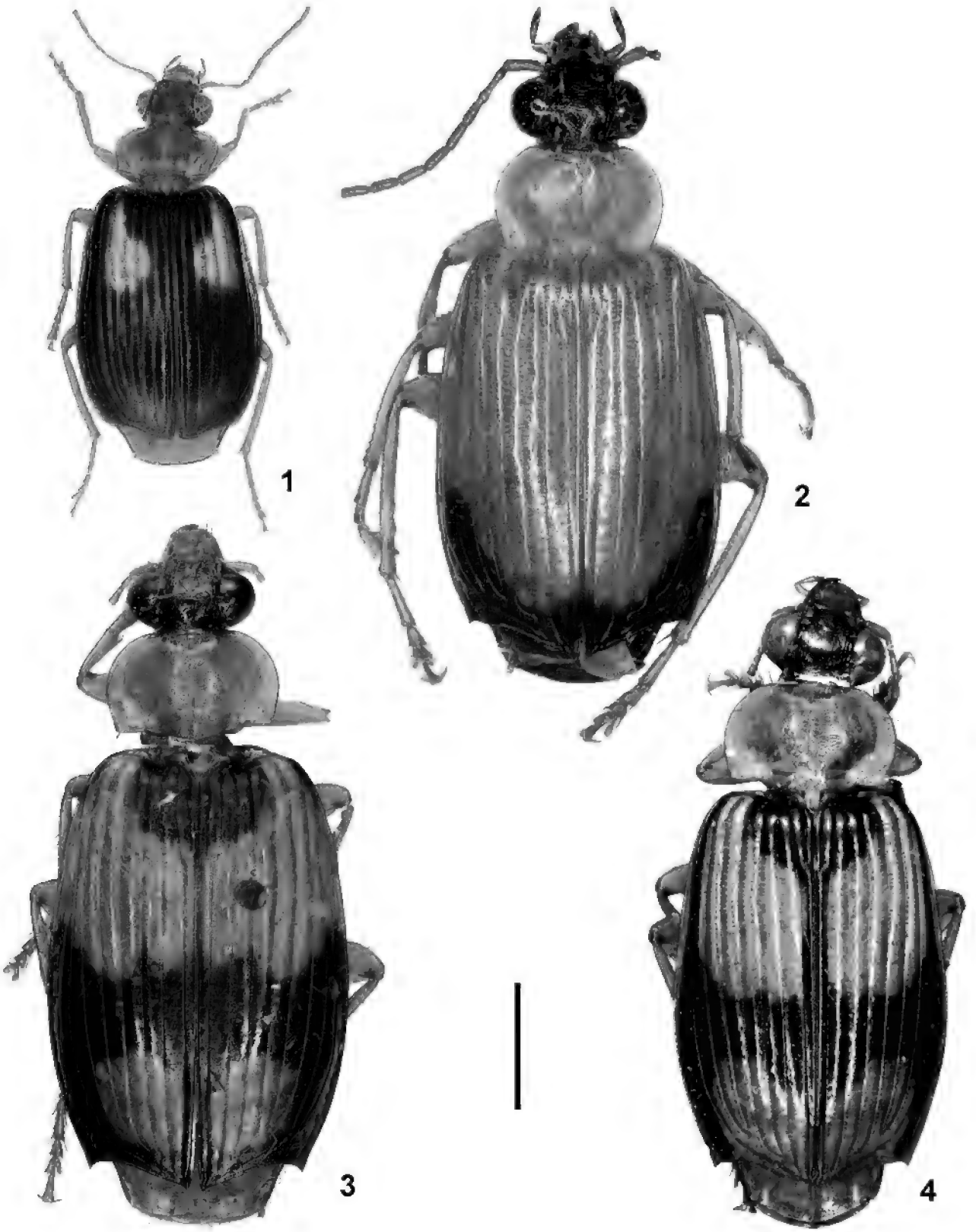
Paratype (1 ♀): Indonesia, Maluku, Halmahera Island, Tobelo, Mamuya, 20–500 m, 12.XI.1999, leg. A. Riedel (SMNS).

Etymology

The species name refers to the known distribution range of the new species, the island of Halmahera.

Diagnosis

A moderately large species with a dark, cruciate elytral pattern that leaves a distinct, elongate humeral-subhumeral spot yellow, and a vague, oblique preapical spot reddish. The new species is distinguished from other Australian-Papuan species of the *Lebia karenia*-group (except for *L. darlingtoniana* Baehr and *L. brisbanensis*



Figs. 1–4. *Lebia* and *Aristolebia* spp., habitus. – **1**. *Lebia halmaherae* n. sp. **2**. *Aristolebia apicalis* n. sp. **3**. *A. oculata* n. sp. **4**. *A. triramosa* n. sp. – Scale bar: 2 mm.

Baehr) by the presence of a denticulate sclerite in the internal sac of the aedeagus. It is distinguished from *L. darlingtoniana* and *L. brisbanensis* by different, less extensively light elytral pattern, and by less widened aedeagus, differently shaped apex, and slightly different shape of the denticulate sclerite in the internal sac.

For further distinction see the key to the species of the *Lebia karenia*-group (chapter 4).

Description

Measurements and ratios. Body length: 5.9–6.1 mm; body width: 2.70–2.75 mm. Width/length of pronotum: 1.52–1.53; width of pronotum/width of head: 1.18–1.19; length/width of elytra: 1.42–1.44; width of elytra/width of pronotum: 1.78–1.80.

Colouration (Fig. 1). Head (including mouth parts) and pronotum reddish, the explanate lateral margins of pronotum and clypeus and labrum gradually changing to yellow. Elytra very dark piceous to almost black, with a distinct, elongate, yellow humeral spot which is covering the 5th and 6th intervals anteriorly and extending to the 3rd to 6th intervals posteriorly. Apex with a very vague, oblique, reddish preapical spot that leaves the extreme apex dark. Lateral margin of the elytra narrowly yellow, marginal setae not encircled by yellow spots. Mouth parts, antenna, legs, and lower surface pale reddish.

Head. Size and shape average, narrower than pronotum. Eyes very large, semicircular. Antenna of moderate size, surpassing basal angles of pronotum by about two antennomeres, median antennomeres slightly <2 times as long as wide. Surface (except labrum which is finely microreticulate) without microreticulation, though with a few wrinkles near eyes and with very fine scattered punctures, distinctly glossy.

Pronotum. Moderately wide (in the *L. karenia*-group), widest at apical third. Apical angles widely rounded off, lateral margin convex anteriorly, oblique and straight in posterior half, slightly sinuate in front of the basal angles which are almost rectangular but slightly obtuse at tip. Base moderately produced in the middle, lateral excision deep, lateral parts of base transversal, very gently convex. Apex margined except in the middle, base coarsely margined, lateral margin explanate throughout, marginal channel wide, moderately deep. Surface with a distinct prebasal, transverse sulcus. Median line almost complete, well impressed. Anterior lateral seta located about

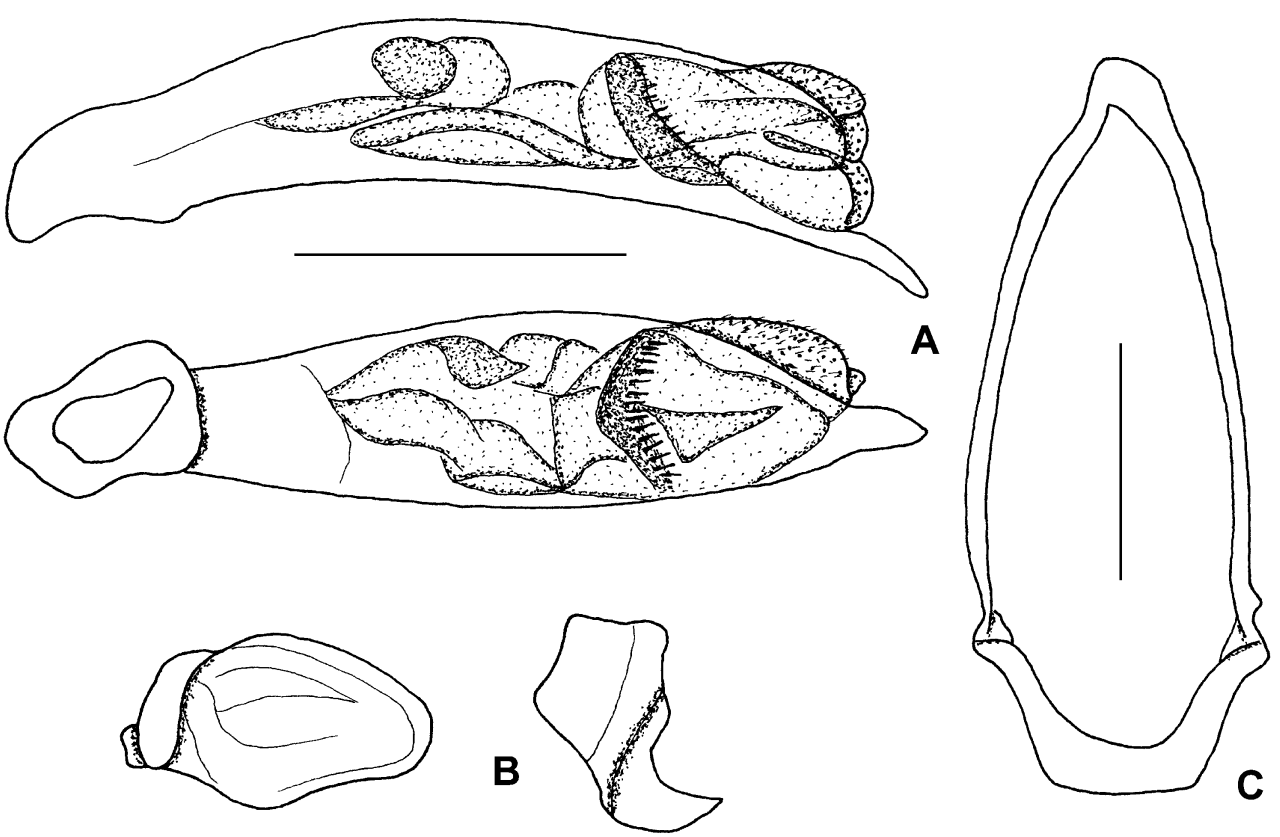


Fig. 5. *Lebia halmaherae* n. sp., male genitalia. – **A** Aedeagus, left side and lower surface. **B** Parameres. **C** Genital ring. – Scale bars: 0.5 mm.

at apical fourth, in front of widest diameter of pronotum. Posterior lateral seta located at basal angle. Surface with rather sparse, more or less superficial transverse wrinkles, with superficial microreticulation in the middle, and with very fine, scattered punctures, very glossy.

Elytra. Comparatively short, slightly oval-shaped, widest behind the middle. Humeri rounded, lateral margin obliquely convex, barely incised at basal third, apex oblique and barely sinuate, apical angles widely rounded, apical margin slightly incurved towards suture. Striae complete, deep, barely crenulate at bottom. Intervals convex throughout. 3rd interval bipunctate, punctures situated near 3rd stria. Series of marginal punctures not interrupted in the middle. Intervals with superficial, irregularly transverse microreticulation and fine, scattered punctures, very glossy. Posterior wings fully developed.

Lower surface. Metepisternum fairly elongate, about 1.7 times as long as wide. Abdomen punctate and pilose, pilosity slightly denser on terminal sternum. Terminal sternum 4-setose in both sexes.

Legs. Of moderate size. 4th tarsomeres very deeply excised. Tarsal claws with 4 elongate teeth.

Male genitalia (Fig. 5). Genital ring elongate, barely asymmetric, parallel, with rather wide, convex apex and elongate basis. Aedeagus moderately elongate, slightly widened in the middle, barely sinuate, lower surface very gently concave. Apex fairly elongate, depressed, straight, slightly arrow-shaped. Orificium moderately elongate. Folding of internal sac complex, at bottom with a characteristic, sinuate, densely denticulate sclerite which is bent upwards laterally on both sides. Also with a moderately sclerotized, not denticulate plate in the middle near roof of internal sac. Parameres of dissimilar shape, left paramere much larger than right one, with triangular, broadly rounded apex; right paramere very short, rhomboidal.

Female genitalia. Gonocoxites of typical *Lebia*-like shape: gonocoxite 2 short, rounded at apex, both gonocoxites lacking setae.

Variation. Apart from the slightly shorter and wider elytra in the female, very little variation noted.

Distribution

So far only recorded from Halmahera Island.

Collecting circumstances

Both specimens were apparently collected in lowland, the holotype in a plantation near a river.

Affinities

The new species is most similar to *L. darlingtoniana* Baehr from New Guinea and Sulawesi in body shape, colour pattern of elytra, and structure of its aedeagus. For the differences see couplet 10a in the key below (chapter 4).

3.2 *Aristolebia apicalis* **n. sp.**
(Figs. 2, 6)

H o l o t y p e (♀): Indonesia, N Sumatra, Siantar, 1.VII.1991, leg. DIEHL (SMNS).

P a r a t y p e (1 ♀): Indonesia, Nord-Sumatra, Umg. P.-Siantar, I.-VII.91 [= 1.VII.1991], DIEHL (CBM/ZSM).

Etymology

The species name refers to the dark apical colour pattern of the elytra.

Diagnosis

Rather large species in the genus *Aristolebia*, distinguished at first glance by the elytral pattern that consists only of a narrow, contrastingly black lateral and apical stripe in the apical two fifths of the pale reddish elytra.

For recognition see also the key below (chapter 5).

Description

Measurements and ratios. Body length: 9.9–10.2 mm; body width: 4.40–4.55 mm. Width/length of pronotum: 1.53–1.56; width of pronotum/width of head: 1.23; length/width of elytra: 1.43–1.47; width of elytra/width of pronotum 1.67–1.69.

Colouration (Fig. 2). Head including clypeus, labrum, and mandibles black, pronotum and elytra red, elytra with apex and posterior two fifths of lateral margin black. Two apical palpomeres of the maxillary palpus, and the apical palpomere of the labial palpus piceous, basal palpomeres red. Antenna more or less dark reddish. Legs yellow to pale reddish. Lower surface of head except mouth parts black, thorax and two basal abdominal sterna pale reddish, rest of abdomen contrastingly black.

Head. Of moderate size. Eyes very large, semicircular, remarkably protruded laterally, orbits not perceptible. Neck with fairly deep transverse impression. Labrum anteriorly slightly convex, 6-setose. Mentum with very shallow, apically transverse or very slightly rounded convexity. Glossa elongate, polysetose at apex, paraglossae wide, foliaceous, as long as glossa and fused to it, densely setose at margin. Galea with wide, rather depressed last segment that is extremely densely pilose. Lacinia large, with very elongate terminal hook and rather dense row of teeth at inner margin. Palpi of normal size, very sparsely pilose. Mentum asetose, but submentum with a very elongate seta at either side. Mandibles short and wide, evenly curved. Antenna fairly elongate, surpassing base of pronotum by almost three antennomeres, pilose from 4th antennomere on, 6th and 7th antennomeres almost 2.75 times as long as wide. Labrum and clypeus with fine and sparse punctures, frons and neck with some wrinkles and with coarse and rather dense punctures. Microreticulation isodiametric, though superficial, thus surface glossy.

Pronotum. Moderately wide. Anterior half about semicircular, widest at or slightly behind the middle, little narrowed towards base, therefore base much wider than apex. Apex slightly concave, apical angles very widely rounded, lateral margin convex, just in front of base oblique and straight, basal angle about 100°, though slightly obtuse at tip, base slightly produced in the middle, slightly convex laterally. Apex narrowly margined, base in the middle not or very feebly margined. Anterior transverse sulcus and median line shallow, sulcus situated close to apex. Posterior transverse sulcus deeply impressed. Lateral margin anteriorly moderately wide, widened and widely explanate towards base. Disk gently convex. Anterior lateral seta situated about at anterior third, slightly removed from margin, posterior seta situated at basal angle. Surface of disk with fine, very irregular strioles, with fine, scattered punctures, and at bottom of the strioles with very superficial, isodiametric microreticulation, glossy.

Elytra. Rather short and wide, widened towards apex, widest about at apical third, upper surface rather depressed. Humeri evenly rounded, lateral margin evenly convex. External apical angle angulate, forming a short, acute denticle. Sutural angle angulate but not spined, apex gently oblique, straight, only near external angles slightly excised. Striae complete, well impressed, not or very feebly crenulate. Intervals slightly raised, but depressed. 3rd interval with two setiferous punctures, both situated at inner margin of 3rd stria, the anterior one at about basal third, the posterior one behind apical fourth. 15–16 marginal setiferous punctures present, series slightly interrupted in the middle. Punctures of intervals sparse but distinct, irregularly uniseriate, in parts biseriate. Intervals with rather superficial, about isodiametric microreticulation which is arranged in irregularly transverse rows, with sparse, very short, erect pilosity which is visible only in lateral view and at high magnification, surface rather glossy. Posterior wings fully developed.

Lower surface. Prosternal process with an elongate seta at the middle. Lower surface with sparse but elongate, erect to slightly declined pilosity. Metepisternum elongate, more than twice as long as wide at anterior margin. Terminal sternum in female 8-setose.

Legs. Of average size. 4th tarsomeres of all legs widened, deeply (> half of tarsomere) excised, with dense tarsal brush. 5th tarsomere with two rows of several setae on lower margin. Claws with 7 elongate teeth.

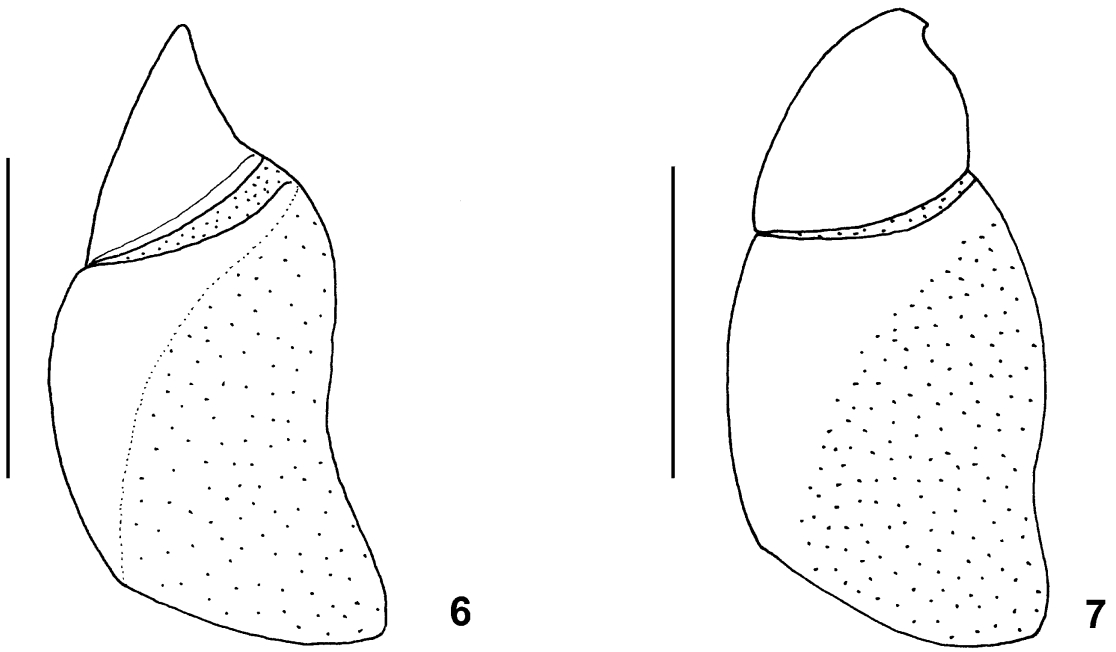
Male genitalia. Unknown.

Female genitalia. Gonocoxites see Fig. 6. Gonocoxite 2 massive, only partly sclerotized, without setae at the apical rim. Gonocoxite 1 small, short and wide, triangular, without setae.

Variation. Very little variation noted.

Distribution

Northern Sumatra. Recorded only from the type locality.



Figs. 6–7. *Aristolebia* spp., female gonocoxites. – **6**. *Aristolebia apicalis* n. sp. **7**. *A. oculata* n. sp. – Scale bars: 0.25 mm.

Collecting circumstances

Both specimens captured in July.

Affinities

With respect to the large size, vivid colour pattern, and structure of the tarsal claws, the new species belongs to the *Aristolebia mucronata*-group. Without knowledge of the male genitalia the relationship to other species must remain unsettled. The outstanding colour pattern does not show a clear affinity to any other species of the genus.

3.3 *Aristolebia oculata* **n. sp.**
(Figs. 3, 7)

Holotype (1 ♀): Indonesia, G. Tompoe, Paloe, W Celebes. 2,700', I.1937. (J. P. A. KALIS) / ROTHSCHILD bequest, B. M. 1939-1 (NHM).

Etymology

The species name refers to the ocellate elytral pattern.

Diagnosis

The new species is a rather large species in the genus *Aristolebia*, distinguished from all vividly patterned species (except *A. triramosa* n. sp.) by the unicolourous red pronotum and the large red spot in the posterior half of the elytra. It is distinguished from *A. triramosa* by the absence of a contiguous dark sublateral stripe, black margin in the apical half of the elytra, a circular light apical spot which is completely encircled by dark colour, and wider elytra (compared with pronotum).

For recognition see also the key below (chapter 5).

Description

Measurements and ratios. Body length: 10.5 mm; body width: 4.8 mm. Width/length of pronotum: 1.55; width of pronotum/width of head: 1.35; length/width of elytra: 1.46; width of elytra/width of pronotum 1.73.

Colouration (Fig. 3). Head black, but clypeus, labrum, and mandibles dark reddish. Pronotum pale reddish; elytra largely pale red, but with a very distinct, black pattern as depicted in Fig. 3 which leaves a very large humeral spot red that meets the basal margin at the 5th and 6th intervals, and extends posteriorly from the suture to the lateral margin; in the posterior elytral half with a large red, approximately circular apical spot which extends from the 2nd to the 6th interval and is distinctly separated from the apex. Lateral margin in the apical half of the elytra black, without any trace of pale margin. Palpi, basal three antennomeres, and legs pale reddish, lower surface pale reddish, abdomen very slightly darker apicad.

Head. Of moderate size. Eyes very large, semicircular, remarkably protruded laterally, orbits not perceptible. Neck with fairly deep transverse impression. Labrum anteriorly slightly convex, 6-setose. Mentum with very shallow, apically transverse or very slightly rounded convexity. Glossa elongate, polysetose at apex, paraglossae wide, foliaceous, as long as glossa and fused to it, densely setose at margin. Galea with wide, rather depressed last segment that is extremely densely pilose. Lacinia large, with very elongate terminal hook and rather dense row of teeth at inner margin. Palpi of normal size, very sparsely pilose. Mentum asetose, but submentum with a very elongate seta at either side. Mandibles short and wide, evenly curved. Antenna broken from 3rd or 4th antennomere, respectively, 2nd and 3rd antennomeres with very sparse and extremely short pilosity. Labrum and clypeus with fine and sparse punctures, frons and neck with some wrinkles and with coarse and rather dense punctures which are not sparser and smaller in the middle. Microreticulation isodiametric, though very superficial, thus surface glossy.

Pronotum. Moderately wide. Anterior half about semicircular, widest slightly behind the middle, little narrowed towards base, base much wider than apex. Apex almost straight, apical angles very widely rounded, lateral margin convex, just in front of base straight and slightly oblique, basal angle slightly more than rectangular, though obtuse at tip, base rather produced in the middle, very slightly convex laterally. Apex narrowly margined, base in the middle very feebly margined. Anterior transverse sulcus and median line shallow, sulcus situated close to apex. Posterior transverse sulcus sligthly deeper impressed. Lateral margin anteriorly moderately wide, widened and widely explanate towards base. Disk gently convex. Anterior lateral seta situated about at anterior third, slightly removed from margin, posterior seta situated at basal angle. Surface of disk with fine, very irregular strioles, with moderately fine, scattered punctures, and with very fine, rather superficial, isodiametric to slightly transverse microreticulation, fairly glossy.

Elytra. Rather short and wide, widened towards apex, widest about at apical third, upper surface rather depressed. Humeri evenly rounded, lateral margin evenly convex. External apical angle angulate, forming a short, acute denticle. Sutural angle angulate but not spined, apex gently oblique, straight, only near external angles slightly excised. Striae complete, well impressed, not perceptibly crenulate. Intervals fairly raised, but not much convex. 3rd interval with two setiferous punctures, both situated at inner margin of 3rd stria, the anterior one at about basal third, the posterior one behind apical fourth. 15 marginal setiferous punctures present, series slightly interrupted in the middle. Setae of very different length. Near apex at end of 4th interval with an additional setiferous puncture. Punctures of intervals rather sparse, fine to moderately fine, very irregularly biseriate. Intervals with superficial, about isodiametric microreticulation which is arranged in

irregularly transverse rows, with sparse, very short, erect pilosity which is visible only in lateral view and at high magnification, surface rather glossy. Posterior wings fully developed.

Lower surface. Prosternal process with an elongate seta at the middle. Lower surface of thorax with sparse and short, more or less erect pilosity, abdomen with more elongate, slightly declined pilosity. Metepisternum elongate, more than twice as long as wide at anterior margin. Terminal sternum in female 8-setose.

Legs. Of average size. 4th tarsomeres of all legs widened, deeply (> half of tarsomere) excised, with dense tarsal brush. 5th tarsomere with two rows of several setae on lower margin. Claws with 7 elongate teeth.

Male genitalia. Unknown.

Female genitalia. Gonocoxites see Fig. 7. Gonocoxite 2 massive, only partly sclerotized, without setae at the apical rim. Gonocoxite 1 small, short and wide, triangular-convex, with a small denticle near apex, without setae.

Distribution

Western Sulawesi. Known only from the type locality.

Collecting circumstances

Holotype captured at medium altitude.

Affinities

With respect to the large size, vivid colour pattern, and structure of the tarsal claws, the new species belongs to the *Aristolebia mucronata*-group. It shows affinities to *A. triramosa* n. sp., which is also from Sulawesi. Knowledge of the male genitalia would be required to fix the actual relationship of this species.

3.4 *Aristolebia triramosa* **n. sp.**
(Figs. 4, 8)

Holotype (♂): Indonesia, N-Sulawesi, 5 km SE Batu-Puith, 250 m, 1°32.43'N 125°07.29'E, 18.II.2009, R. GERSTMEIER (CBM/ZSM).

Etymology

The species name refers to the three uninterrupted, narrow black lines which run anteriad along suture and 8th interval of the elytra.

Diagnosis

The new species is a rather large species in the genus *Aristolebia*, distinguished from all vividly patterned species (except *A. oculata* n. sp.) by the unicolourous red pronotum and the large red spot in the posterior half of the elytra. It is distinguished from *A. oculata* by the presence of a contiguous dark sublateral stripe, narrow reddish margin in the apical half of the elytra, an oblique light apical spot which broadly touches the apex, and narrower elytra (compared with pronotum).

For recognition see also the key below (chapter 5).

Description

Measurements and ratios. Body length: 9.6 mm; body width: 4.4 mm. Width/length of pronotum: 1.57; width of pronotum/width of head: 1.35; length/width of elytra: 1.45; width of elytra/width of pronotum 1.59.

Colouration (Fig. 4). Head black, but anterior part of frons, clypeus, labrum, and mandibles dark reddish. Pronotum pale reddish; elytra largely pale red, but with a very distinct cruciate black pattern as depicted in Fig. 4, which leaves a very large humeral spot red that meets the basal margin at the 5th and 6th intervals, and extends from 2nd to mid of 7th interval posteriorly; posterior elytral half with a very large red, oblique apical spot which extends from the suture to the 7th interval and broadly meets the apex. Elytra with a black sublateral stripe along its entire length, but the very lateral margin pale. Palpi, antenna, and legs pale reddish, antenna from 4th antennomere on slightly darker. Lower surface pale reddish, abdomen slightly darker apicad.

Head. Of moderate size. Eyes very large, semicircular, remarkably protruded laterally, orbits not perceptible. Neck with fairly deep transverse impression. Labrum anteriorly slightly convex, 6-setose. Mentum with very shallow, apically transverse or very slightly rounded convexity. Glossa elongate, polysetose at apex, paraglossae wide, foliaceous, as long as glossa and fused to it, densely setose at margin. Galea with wide, rather depressed last segment that is extremely densely pilose. Lacinia large, with very elongate terminal hook and rather dense row of teeth at inner margin. Palpi of normal size, very sparsely pilose. Mentum asetose, but submentum with a very elongate seta at either side. Mandibles short and wide, evenly curved. Antenna fairly elongate, surpassing base of pronotum by almost three antennomeres, 2nd and 3rd antennomeres with very sparse and extremely short pilosity, antenna densely pilose from 4th antennomere on, 6th and 7th antennomeres almost 3 times as long as wide. Labrum and clypeus with fine and sparse punctures, frons and neck with some wrinkles and with coarse and rather dense punctures which are sparser and smaller in the middle. Microreticulation isodiametric, though very superficial, thus surface glossy.

Pronotum. Moderately wide. Anterior half about semicircular, widest slightly behind the middle, little narrowed towards base, base much wider than apex. Apex straight, apical angles very widely rounded, lateral margin convex, just in front of base straight and slightly oblique, basal angle about 100°, though slightly obtuse at tip, base rather produced in the middle, laterally very slightly

convex. Apex narrowly margined, base in the middle very feebly margined. Anterior transverse sulcus and median line shallow, sulcus situated close to apex. Posterior transverse sulcus slightly deeper impressed. Lateral margin anteriorly moderately wide, widened and widely explanate towards base. Disk gently convex. Anterior lateral seta situated about at anterior third, slightly removed from margin, posterior seta situated at basal angle. Surface of disk with fine, very irregular strioles, with moderately fine, scattered punctures, and with very fine, rather superficial, isodiametric to slightly transverse microreticulation, fairly glossy.

Elytra. Rather short and wide, widened towards apex, widest about at apical third, upper surface rather depressed. Humeri evenly rounded, lateral margin evenly convex. External apical angle angulate, forming a short, acute denticle. Sutural angle angulate but not spined, apex gently oblique, straight, only near external angles slightly excised. Striae complete, well impressed, very feebly crenulate. Intervals fairly raised, convex, not depressed. 3rd interval with two setiferous punctures, both situated at inner margin of 3rd stria, the anterior one at about basal third, the posterior one behind apical fourth. 14 marginal setiferous punctures present, series slightly interrupted in the middle. Setae of very different length. Near apex at end of 4th interval with an additional setiferous puncture. Punctures of intervals rather sparse, fine to moderately coarse, irregularly biseriate. Intervals with superficial, about isodiametric microreticulation which is arranged in irregularly transverse rows, with sparse, very short, erect pilosity which is visible only in lateral view and at high magnification, surface glossy. Posterior wings fully developed.

Lower surface. Prosternal process with an elongate seta at the middle. Lower surface of thorax with sparse and short, more or less erect pilosity, abdomen with more elongate, slightly declined pilosity. Metepisternum elongate, more than twice as long as wide at anterior margin. Terminal sternum in male 2-setose.

Legs. Of average size. 4th tarsomeres of all legs widened, deeply (> half of tarsomere) excised, with dense

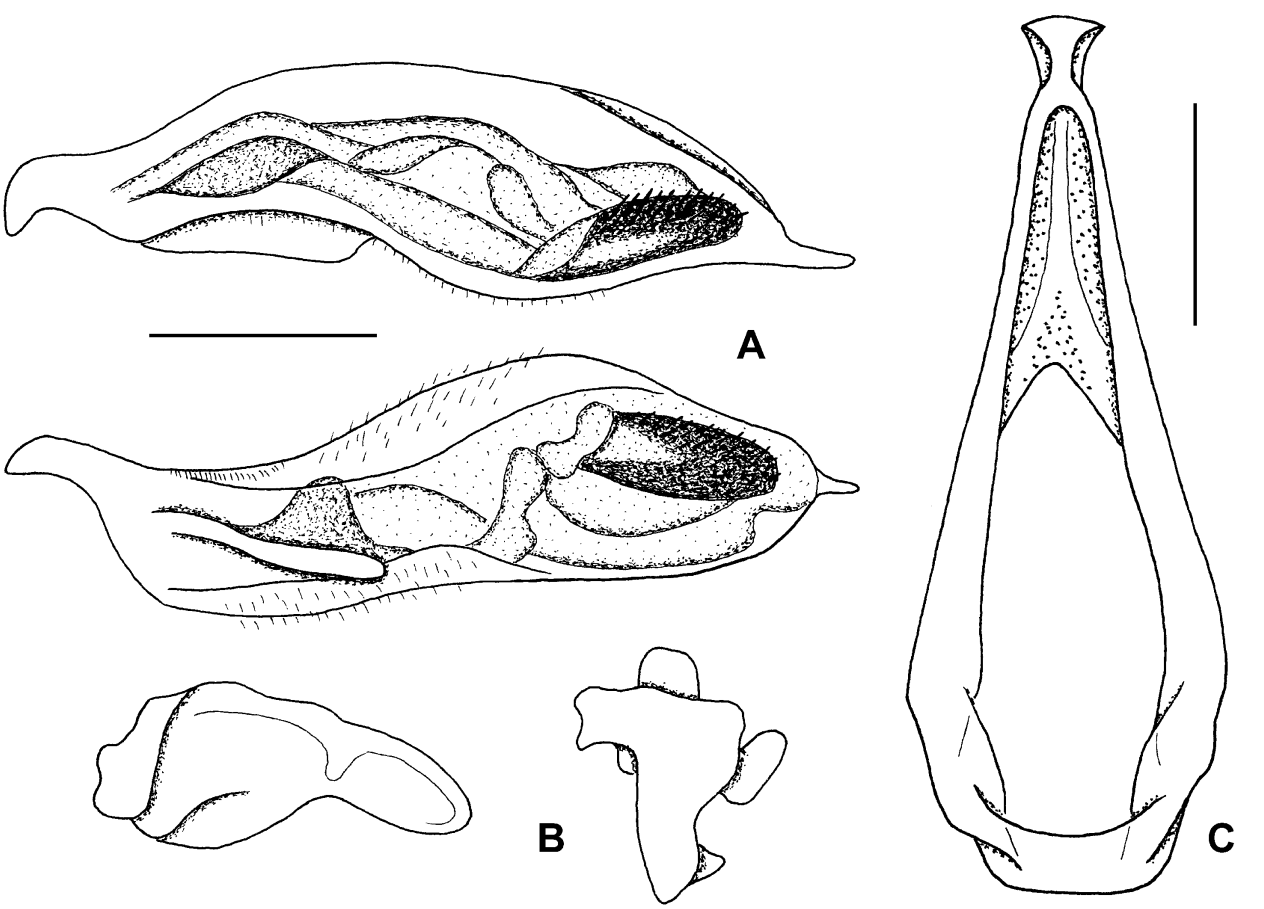


Fig. 8. *Aristolebia triramosa* n. sp., male genitalia. – **A** Aedeagus, left side and lower surface. **B** Parameres. **C** Genital ring. – Scale bars: 0.5 mm (A, B), 1 mm (C).

tarsal brush. 5th tarsomere with two rows of several setae on lower margin. Claws with 7 elongate teeth. 1st–3rd tarsomeres of male protarsus biseriately squamose.

Male genitalia (Fig. 8). Both, aedeagus including parameres, and genital ring very heavily sclerotized. Genital ring very large, almost twice the length of the aedeagus, narrow, gently convex, symmetric, with shoehorn-shaped, symmetric apex which is remarkably curved inwards. Aedeagus moderately elongate, compact, both dorso-ventrally and laterally markedly sinuate, base with a narrow, median keel. Lower surface laterally with short pilosity. Orificium rather short, very gently turned to the left. Apex very narrow, straight, peg-like. Internal sac with very heavily sclerotized, denticulate, slightly twisted plate-like apical part near bottom, otherwise with rather simple folding. Parameres very dissimilar, asetose, left one elongate, right one odd-shaped.

Female genitalia. Unknown.

Distribution

North Sulawesi. Known only from the type locality.

Collecting circumstances

Probably sampled from fallen logs, at low altitude.

Affinities

With respect to the large size, vivid colour pattern, and structure of the tarsal claws, the new species belongs to the *Aristolebia mucronata*-group. It shows strong affinities to *A. oculata* n. sp., which is also from Sulawesi.

4 Revised key to the Papuan-Australian species of the *Lebia karenia*-group

For the inclusion of *Lebia halmaherae* n. sp., the parts covering the *Lebia karenia*-group in the most recent keys to the species of the genus *Lebia* of the Papuan-Australian region (Baehr 2004a: 239; 2005: 39; 2007: 172) are altered as follows:

8 Apex of dark elytral spot characteristically angulate, marginal pores encircled by a small reddish spot (Baehr 2004a: fig. 22); pronotum densely microreticulate, dull; aedeagus barely widened, with elongate, acute apex, internal sac with three small denticulate sclerites (Baehr 2004a: fig. 1). – India, Burma, Thailand. ***karenia*** Bates

– Apex of dark elytral spot not angulate, marginal pores unicolourous (Baehr 2004a: figs. 23–26); pronotum barely microreticulate, glossy; aedeagus widened in the middle or near the apex, with shorter, more obtuse apex, internal sac either without any denticulate sclerites (Baehr 2004a: fig. 4) or with sinuate denticulate band at bottom (Baehr 2004a: figs. 2, 3). – Sulawesi, Halmahera, New Guinea, Australia. **9**

9 Pronotum wider (ratio width/length > 1.67), surface very glossy, wrinkles far less dense; internal sac of aedeagus without any denticulate sclerites. **9a**

– Pronotum narrower (ratio width/length < 1.61), surface less glossy, with dense wrinkles; internal sac of aedeagus at bottom with a denticulate sclerite (Fig. 1; Baehr 2004a: figs. 2, 3). **10**

9a Disk of pronotum black; apex of aedeagus rather wide, rectangular, spade-shaped (Baehr 2005: fig. 1). – New Britain. ***weigeli*** Baehr

– Pronotum unicolourous reddish; apex of aedeagus acute (Baehr 2007: fig. 1; Baehr 2004a: fig. 4). **9b**

9b Apical spot on elytra smaller, apex of elytra never completely yellow (Baehr 2004a: fig. 26); aedeagus gently curved on lower surface, apex longer (Baehr 2004a: fig. 4). – New Guinea. ***fallaciosa*** Baehr

– Apical spot on elytra larger, apex of elytra almost completely yellow (Baehr 2007: fig. 2); aedeagus straight on lower surface, apex shorter (Baehr 2007: fig. 1). – Northeastern Australia. ***edentata*** Baehr

10 Dark sutural spot and lateral margin of elytra completely separated (Baehr 2004a: fig. 25); aedeagus with wide and likewise complexly sinuate denticulate band (Baehr 2004a: fig. 3). – Australia (southeastern Queensland). ***brisbanensis*** Baehr

– Dark sutural spot and lateral margin separated or not (Fig. 1; Baehr 2004a: figs. 23, 24); denticulate band of aedeagus either less complexly sinuate (Baehr 2004a: fig. 2), or narrower (Fig. 5). – Halmahera, Sulawesi, New Guinea. **10a**

10a Basal light spot on elytra larger, dark area in the middle less extensive, apical light spot conspicuous, or dark sutural spot and lateral margin separated (Baehr 2004a: figs. 23, 24); aedeagus widened near apex, with somewhat spatulate apex, and with wider though less complexly sinuate denticulate band (Baehr 2004a: fig. 2). – Sulawesi, New Guinea. ***darlingtoniana*** Baehr

– Basal light spot on elytra smaller, dark area in the middle extensive, apical light spot inconspicuous, vaguely confined (Fig. 1); aedeagus not widened near apex, with somewhat arrow-shaped apex, and with narrower though more complexly sinuate denticulate band (Fig. 5). – Halmahera. ***halmaherae* n. sp.**

5 Key to the species of *Aristolebia* Bates

1 Colouration almost uniformly light brown or piceous. **2**

– Vivid colour pattern present on elytra. **3**

2 Body length < 8 mm. – New Guinea, Australia (eastern Queensland). ***wau*** Darlington

– Body length about 12 mm. – China. ***prattiana*** (Bates)

3 Sutural angle of elytra rounded; tarsal claws with 5 small teeth. – Western Irian Jaya (Vogelkop Peninsula). ***capitis*** Darlington

– Sutural angle of elytra angulate; tarsal claws with 7 small teeth. **4**

4 Elytra with cruciate colour pattern (Baehr 2004b: fig. 1); body length < 7.5 mm. – Thailand. ***crucigera*** Baehr

– Colour pattern of elytra different and body length > 8 mm, usually considerably larger (if about 8 mm long, then elytra with anchor-shaped dark spot in the posterior half – see Jedlicka 1963: fig. 45 – and geographic range Philippine Islands). **5**

5 Elytra with anchor-shaped dark spot in posterior half (see Jedlicka 1963: fig. 45). – Philippine Islands. ***davaonis*** (Heller)

– Colour pattern of elytra different; distribution different (Burma, Sumatra, Sulawesi, New Guinea, Australia). **6**

6 Elytra light red, only the latero-apical margin narrowly black (Fig. 2). – Sumatra. ..... ***apicalis* n. sp.**
– Colour pattern of elytra different; distribution different. ... **7**
7 Pronotum uniformly red; apical half of elytra black with a large red spot on either elytron; lateral margin of elytra not continuously black (Figs. 3, 4). – Sulawesi. **8**
– Disk of pronotum black; elytra either black with a large red spot in the basal half on either elytron, or with a black spot along suture which is widened behind scutellum and in the apical half; lateral margin of elytra continuously black..... **9**
8 Elytra with a contiguous dark sublateral stripe, lateral margin in the apical half narrowly reddish; light apical spot oblique and broadly attaining the apex (Fig. 4); elytra narrower compared to pronotum (ratio width elytra/width pronotum 1.59); aedeagus see Fig. 8. – North Sulawesi..... ***triramosa* n. sp.**
– Elytra without contiguous dark sublateral stripe, lateral margin in the apical half black; light apical spot circular and completely encircled by dark colour (Fig. 3); elytra wider compared to pronotum (ratio width elytra/width pronotum 1.73); aedeagus unknown. – West Sulawesi..... ***oculata* n. sp.**
9 Elytra black with a large red spot in basal half on either elytron. – Burma, Thailand..... ***quadridentata*** Bates
– Elytra with a black spot along suture which is widened behind scutellum and in apical half. – New Guinea, northern Australia. ..... ***mucronata*** (Sloane)

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First record of *Cephennula* Jałoszyński from Thailand, with description of a new species (Coleoptera: Staphylinidae: Scydmaeninae)

Paweł Jałoszyński

Abstract

Cephennula porcata **n. sp.** from Thailand (Phang Nga) is described and illustrated. A key to the identification of all known species of *Cephennula* Jałoszyński, 2008 is provided. The new species is the first record of this cephenniine genus from Thailand.

Keywords: Coleoptera, Staphylinidae, Scydmaeninae, Cephenniini, *Cephennula*, Oriental, Thailand, taxonomy, new species.

Zusammenfassung

Cephennula porcata **n. sp.** aus Thailand (Phang Nga) wird beschrieben und abgebildet. Ein Bestimmungsschlüssel zu allen bekannten Arten von *Cephennula* Jałoszyński, 2008 wird beigefügt. Die neue Art ist der erste Nachweis dieser Cephenniinen-Gattung aus Thailand.

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3 Key to species of *Cephennula* Jałoszyński 126
4 References 126

1 Introduction

Cephennula Jałoszyński (Scydmaeninae, Cephenniini) was very recently described, and was hitherto known to include four species distributed in Malaysia and Indonesia: *C. multicarinata* Jałoszyński and *C. minuta* Jałoszyński from Borneo, and *C. secunda* Jałoszyński and *C. scaphisoma* Jałoszyński from the Malay Peninsula (Jałoszyński 2008). These are very small species of the Cephenniini which share a number of characters with *Cephennomicrus* Reitter, 1907. Taking into account that merely six individuals representing this genus have been found so far by the author among thousands of specimens collected in the Malay Peninsula and the Sunda Islands, species of *Cephennula* seem to be extremely rare. In this paper the discovery of a new species in Thailand is reported.

Measurement methods and nomenclature used in the descriptive part below follow Jałoszyński (2008).

Acronym of depository

SMNS Staatliches Museum für Naturkunde, Stuttgart, Germany

Acknowledgements

I express my thanks to Wolfgang Schawaller (SMNS), for the loan of the specimens used for this study, and to Peter Hlaváč (Košice) and Heinrich Meybohm (Stelle) for the review of the manuscript.

2 Taxonomy

Cephennula porcata **n. sp.**
(Figs. 1–5)

Holotype (♂): S Thailand, Phang Nga Prov., Khao Lak National Park, Thone Chong Fa Fall, 100–300 m, 6.–15.I.1998, leg. A. Schulz & K. Vock, SMNS.

Etymology

The Latin adjective "porcatus" (= marked with raised longitudinal lines) refers to the longitudinal carinae on the pronotum and elytra of this species.

Description of male (female unknown)

Body (Figs. 1–2) moderately large, 1.01 mm in length, elongate but compact, with a very weakly marked constriction between pronotum and elytra, slightly convex; pigmentation light brown, vestiture slightly lighter than cuticle.

Head moderately large, length 0.14 mm, width 0.25 mm; vertex and frons confluent, convex; ocelli and frontal glands not visible under 80 times magnification;

Fig. 1. *Cephennula porcata* n. sp., holotype ♂. – Scale: 0.2 mm.

supra-antennal tubercles feebly marked; eyes very large, strongly convex, coarsely faceted. Punctures on frons and vertex indistinct, extremely small and shallow, barely visible under 80 times magnification; setae short, sparse, suberect. Antennae as in Fig. 3, length 0.48 mm.

Pronotum nearly subrectangular in strictly dorsal view, equally broad from anterior third to base, length 0.30 mm, width 0.45 mm; anterior margin weakly arcuate; lateral margins distinctly microserrate, strongly rounded in anterior third, straight in posterior half; hind angles of pronotum sharp and acute; posterior margin with shallow and short lateral emarginations; sublateral carinae very distinct, entire; ante-basal pits very small, internal pair indistinct, connected by a narrow and distinct transverse groove. Punctures on pronotal disc between sublateral carinae very small and extremely shallow, separated by spaces about as long as puncture diameters, cuticle glossy; punctures on sides of pronotum situated between lateral and sublateral carinae distinctly deeper and denser, but not coarse; setae short, moderately dense, suberect, pronotum also bearing a single long and erect seta on each lateral margin near anterior third.

Elytra oval, broadest distinctly anterior to middle, only slightly broader than pronotum, length 0.58 mm, width 0.48 mm. Basal pit on each elytron small but distinct; humeri weakly marked; subhumeral and humeral carinae equal in length, about one-third of elytral length; elytral apices separately rounded. Punctures more distinct than those on median part of pronotum, small and very shallow, very densely distributed; setae moderately long and dense, suberect; each elytron also bearing several longer and more erect setae in posterior half.

Metathoracic wings not studied.

Legs relatively short, but very slender.

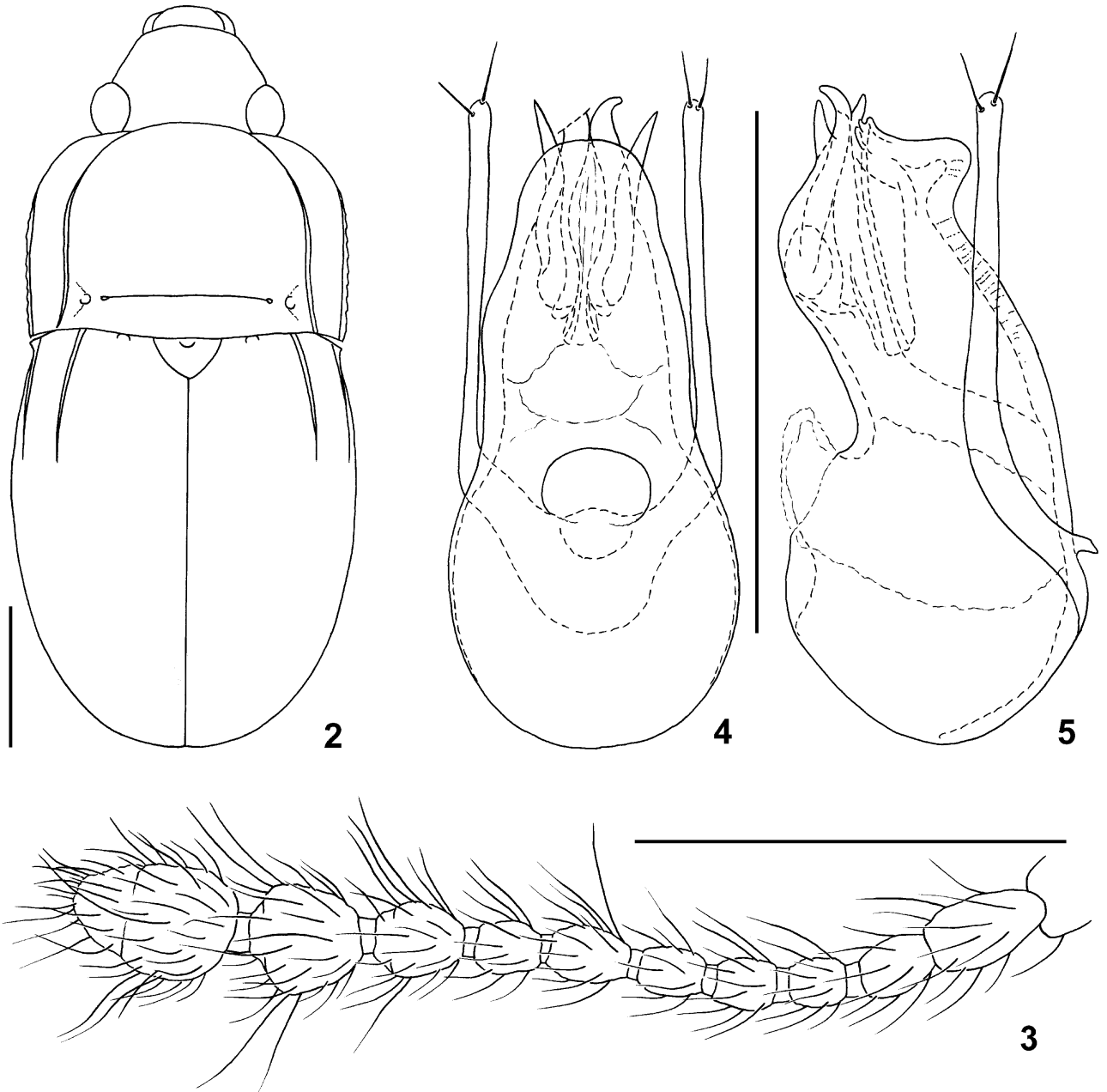
Aedeagus (Figs. 4–5) large, 0.25 mm in length, median lobe narrowing towards rounded apex in ventral view; bent ventrally above the basal capsule in lateral view; internal armature with two pairs of long apical sclerites; external sclerites straight and pointed, internal pair recurved; parameres long, robust, each with two apical setae.

Diagnosis

Body length ca. 1 mm; antennae nearly as long as half body length; subhumeral and humeral carina equal in length on each elytron; aedeagus in ventral view with two pairs of elongate apical sclerites in internal sac.

Remarks

The complicated internal armature and unusual shape of the exceptionally large aedeagus are unambiguous diagnostic characters of *C. porcata*; all other species of the genus have much more simple copulatory organs. The new species differs also from all remaining congeners in a number of external characters, mainly the size and proportions of various body parts. The body length of 1.01 mm is much larger than that of *C minuta*, *C. secunda*, and *C. multicarinata*; all these species only reach 0.78–0.83 mm. *Cephennula scaphisoma*, on the other hand, is distinctly larger (1.11 mm in length) and broader (width of pronotum 0.50 vs. 0.45, width of elytra 0.53 vs. 0.48) than *C. porcata*, and has the elytra strongly narrowing towards the apices, whereas the new species has weakly narrowed elytra. Furthermore, *C. porcata* has the longest and least compact antennae equal to 0.47 of the body length, whereas the remaining species have shorter antennae equaling 0.32 (*C. minuta*), 0.35 (*C. secunda*), 0.36 (*C. multicarinata*), and 0.38 (*C. scaphisoma*) of the body length. The known species of *Cephennula* can be distinguished using the key of chapter 3.



Figs. 2–5. *Cephennula porcata* n. sp., holotype ♂. – **2**. Simplified body outline. **3**. Left antenna in dorsal view. **4–5**. Aedeagus in ventral (4) and lateral (5) views. – Scales: 0.2 mm.

3 Key to species of *Cephennula* Jałoszyński

1 Subhumeral and humeral carinae on elytra equal or nearly equal in length. **2**
– Humeral carina about half as long as subhumeral carina. .. **4**
2 Body length < 0.8 mm. ..... ***C. secunda*** Jałoszyński
– Body length 1 mm or more **3**
3 Elytra broadest near anterior fourth. .... ***C. scaphisoma*** Jałoszyński
– Elytra broadest behind anterior third. ..... ***C. porcata* n. sp.**
4 Sides of pronotum and elytra with several additional long, strongly erect setae; apex of aedeagus subtrapezoidal..... ..... ***C. multicarinata*** Jałoszyński
– Sides of pronotum and elytra without long setae; apex of aedeagus subtriangular. ..... ***C. minuta*** Jałoszyński

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Two new species of Himalayan and sub-Himalayan *Neuraphes* Thomson (Coleoptera: Staphylinidae: Scydmaeninae)

Paweł Jałoszyński

Abstract

Neuraphes (Pararaphes) mephistopheles **n. sp.** from Nepal (Taplejung), and *N. (P.) qinghaiensis* **n. sp.** from China (Qinghai) are described, illustrated, and compared to allied species.

Keywords: Coleoptera, Staphylinidae, Scydmaeninae, *Neuraphes*, *Pararaphes*, Himalaya, Nepal, Tibet, China, taxonomy, new species.

Zusammenfassung

Neuraphes (Pararaphes) mephistopheles **n. sp.** aus Nepal (Taplejung) und *N. (P.) qinghaiensis* **n. sp.** aus China (Qinghai) werden beschrieben, abgebildet und mit ähnlichen Arten verglichen.

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1 Introduction

The Himalayan species of *Neuraphes* Thomson, 1859 (Scydmaeninae: Cyrtoscydmini) were very recently revised by Jałoszyński (2008). As a result, several misidentifications and synonyms were found, and the presently known six members of the genus occurring in the Himalaya Mountains and Tibet were dealt with. The valid species are: *N. aruensis* Franz, 1979, *N. himalayanus* Franz, 1970 *N. jumlanus* Franz, 1974, *N. taksangensis* Franz, 1973 *N. khumbuanus* Jałoszyński, 2008 (all from Nepal), and *N. tibetanus* Jałoszyński, 2008 (from Tibet). All these species are members of the subgenus *Pararaphes* Reitter, 1891, characterized by lacking foveae on the vertex. Since most East Palearctic members of this genus seem to be associated with cool or mountainous areas (e. g., Himalaya Mountains, Russian Far East, Hokkaido), the very small number of species reflects the inadequate knowledge of the Scydmaeninae of this region rather than the actual biodiversity of the genus. Indeed, my further studies on Himalayan and sub-Himalayan taxa resulted in the discovery of two new species, which are described below.

Measurement methods and nomenclature follow Jałoszyński (2008).

Acronym of depository

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Acknowledgements

I express my thanks to Wolfgang Schawaller (SMNS), for the loan of the specimens used for this study, and to Peter Hlaváč (Košice) and Heinrich Meybohm (Stelle) for the review of the manuscript.

2 Taxonomy

Neuraphes (Pararaphes) mephistopheles **n. sp.** (Figs. 1, 3–6)

Holotype (♂): Nepal, Taplejung Distr., Lassetham, NW Yamputhin, 3300–3500 m, 6.–9.V.1988, leg. J. Martens & W. Schawaller, SMNS.

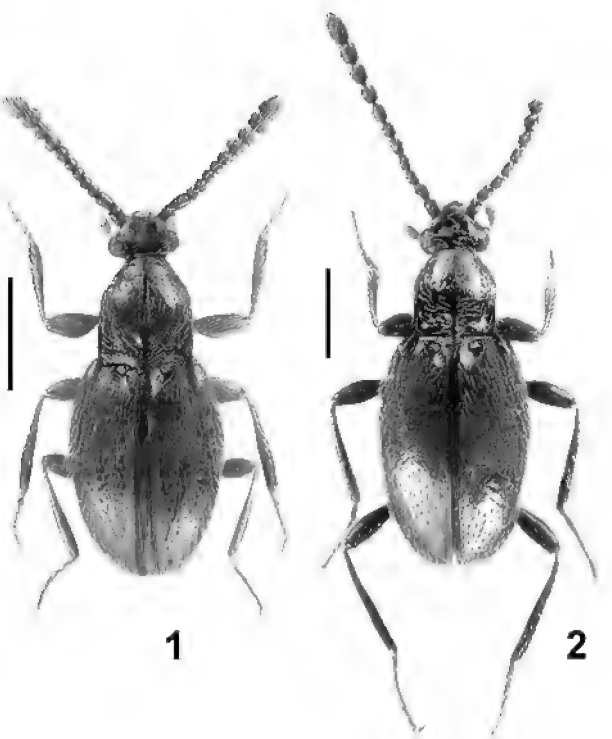
Etymology

The species name is derived from the devil Mephistopheles in the Faust legend, and refers to the pair of horns on the head of this species.

Description of male (female unknown)

Body (Fig. 1) light brown, with slightly lighter tarsi and palps, moderately slender in dorsal view, strongly convex, covered with a light brown vestiture; body length 1.58 mm.

Head (Fig. 3) small, length 0.20 mm, width 0.30 mm; occipital constriction much broader than half width of head; posterior margin of vertex developed as a transverse ridge, which is strongly expanded at each side, and forms a pair of prominent, subconical lateral horns; median part



Figs. 1–2. *Neuraphes* spp. – **1**. *N. mephistopheles* n. sp., holotype ♂. **2**. *N. qinghaiensis* n. sp., holotype ♂.– Scales: 0.5 mm.

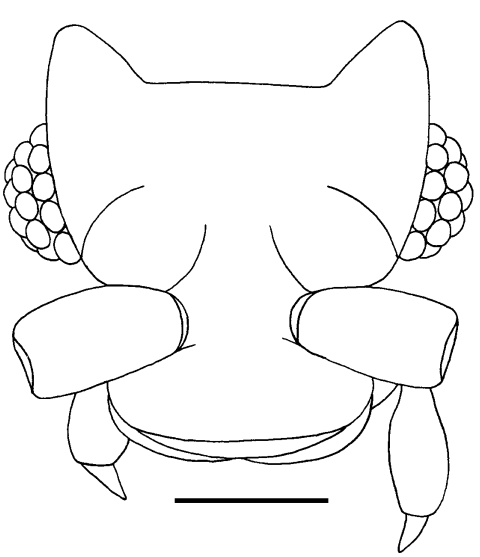


Fig. 3. *Neuraphes mephistopheles* n. sp., holotype ♂, simplified outline of head in frontal view. – Scale: 0.1 mm.

of vertex and posterior part of frons concave; anterior part of frons convex between antennal insertions; clypeus convex; supra-antennal tubercles large and well-marked; eyes large, strongly convex, coarsely faceted. Punctures on median part of vertex very fine, moderately distinct, very sparse; setae on median part of vertex and on entire frons short, sparse and suberect, those on lateral horns slightly denser, directed dorsally. Antennae short, moderately slender, length 0.75 mm; antennomere I twice as long as broad; II distinctly narrower and shorter than I, 1.8 times as long as broad; III slightly narrower than II and very short, distinctly transverse; IV–V equal in length and width, each as broad as III but slightly longer, only slightly broader than long; VI slightly broader but not longer than V, distinctly broader than long; VII distinctly broader and longer than VI, slightly broader than long; VIII larger than VII, distinctly broader than long; IX–X each of the same shape as VIII but gradually larger; XI slightly narrower than X, distinctly shorter than IX–X together.

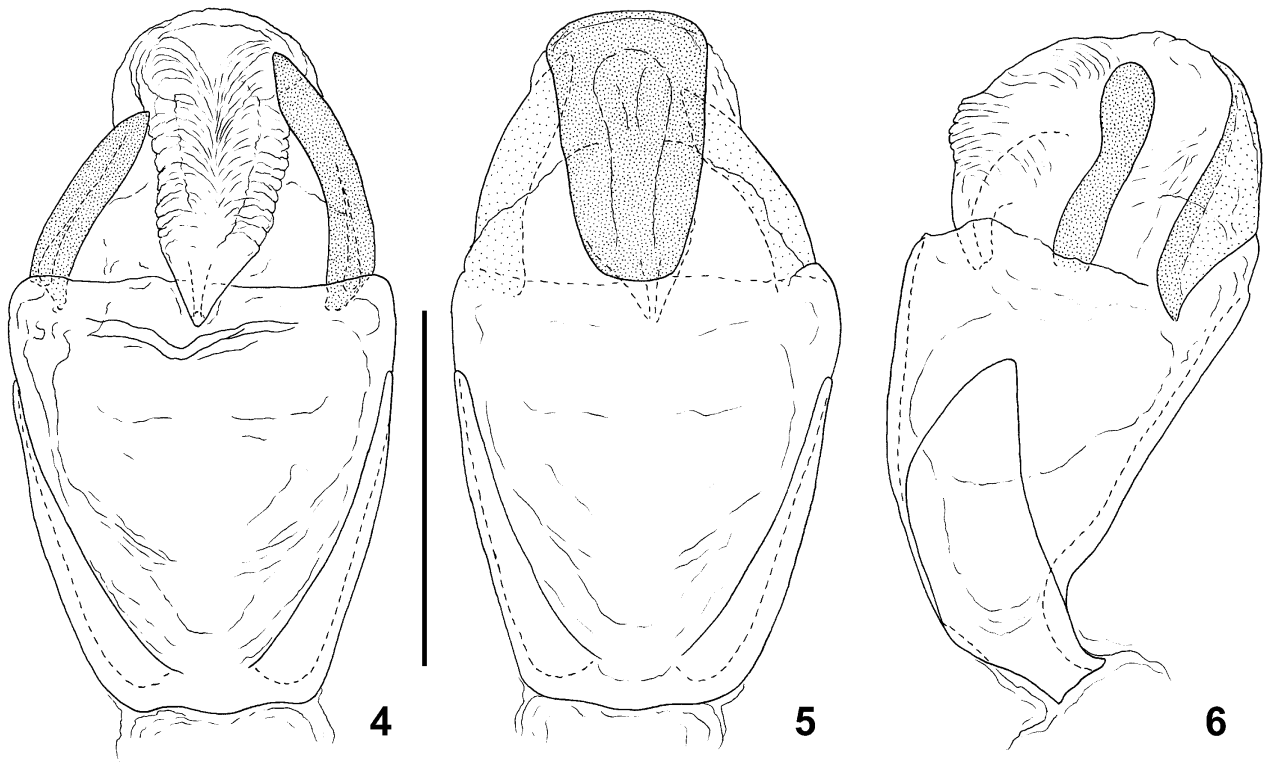
Pronotum elongate in dorsal view, subtrapezoidal, broadest at base, length 0.45 mm, width 0.38 mm; anterior margin broadly and strongly rounded; lateral margins strongly rounded in anterior third, straight in posterior half, slightly divergent towards slightly obtuse, acute hind angles; posterior margin arcuate; base with two transversally elongate lateral pits and a pair of shallow median pits which are separated by a very distinct median longitudinal carina nearly reaching to anterior fifth of pronotum. Punctures on narrow area along each side of median carina large but shallow, separated by spaces which are equal to or slightly shorter than puncture diameters; punctures on sides of pronotal disc similarly dense, but much smaller and indistinct; setae sparse, moderately long, suberect on disc, and erect on anterior and lateral margins of pronotum.

Elytra oval, broadest between middle and anterior third, length 0.93 mm, width 0.65 mm, elytral index (length/width) 1.42. Humeral calli well-marked as elongate, longitudinal wrinkles; basal pit on each elytron moderately large, closer situated to scutellum than to humerus; short adsutural area at base raised, round circumsutural area posterior to raised region slightly flattened; apices of elytra separately rounded; each elytron bears a large pore on subapical region, surrounded by slightly raised cuticle, and separated from apex of elytron by a space as long as pore diameter, and from suture by a space shorter than pore diameter. Punctures on flattened median area large but very shallow, with slightly diffused margins, separated by spaces about equal to puncture diameters; punctures gradually smaller and less distinct towards lateral and posterior margins of elytra; setae similar to those on pronotum, but slightly thicker.

Hind wings well-developed, functional.

Legs long and slender, without modifications.

Aedeagus (Figs. 4–6) 0.20 mm in length, stout, with very large and long, subtrapezoidal median apical plate



Figs. 4–6. *Neuraphes mephistopheles* n. sp., aedeagus in dorsal (4), ventral (5), and lateral (6) views. – Scale: 0.1 mm.

and narrow lateral apical plates; parameres short and very broad, with subtriangular apices.

Diagnosis

This conspicuous species can be easily distinguished from all congeners on the basis of the uniquely modified vertex with a pair of broadly separated "horns". Moreover, in the Himalaya Mountains, only *N. taksangensis* and *N. aruensis* have uniformly brown bodies similar to that of the new species (all other Himalayan species have head and pronotum much darker than elytra), but they have a distinctly shorter median carina on the pronotum, different proportions of the body parts, and different structures of the aedeagi.

Neuraphes (Pararaphes) qinghaiensis **n. sp.**
(Figs. 2, 7–9)

Holotype (♂): China, Qinghai Prov. (Tibetan Plateau), Bei Shan National Park, 120 km NE Xining, 23.V.–8.VI.1996, 2300–2700 m, leg. J. MARTENS, SMNS.

Etymology

Locotypical, after the type locality, Qinghai Province in Chinese Tibet.

Description of male (female unknown)

Body (Fig. 2) distinctly bicolorous, head and pronotum very dark brown, nearly black, elytra reddish-brown; antennae, maxillary palps and tarsi lighter than elytra; femora slightly darker than elytra; tibiae slightly lighter than femora in their basal half, distinctly lighter in their distal half; body slender, moderately convex; vestiture grayish on dark body parts, yellowish on light body parts; body length 2.08 mm.

Head moderately small, length 0.33 mm, width 0.40 mm; occipital constriction as broad as two-thirds of head width; vertex convex, with a pair of small, slightly oval and very shallow impressions located on its anterior part just posterior to supra-antennal tubercles, separated by a space as long as 3 times their diameter; frons subtrapezoidal, steeply lowering towards convex clypeus; supra-antennal tubercles small but distinct; eyes very large, strongly convex, coarsely faceted. Punctures on vertex and frons indistinct, surface of cuticle slightly uneven; setae short, sparse, suberect to erect. Antennae very long, slender, length 1.25 mm; antennomere I 2.3 times as long as broad; II slightly narrower and much shorter than I, twice as long as broad; III slightly narrower and much shorter than II, 1.5 times as long as broad; IV as broad as II but slightly longer, 1.7 times as long as broad; V slightly

broader and distinctly longer than IV, 1.8 times as long as broad; VI as broad as V but slightly shorter, 1.5 times as long as broad; VII slightly broader and longer than VI, 1.6 times as long as broad; VIII–IX subequal in size, each about as long as VII but slightly broader, 1.5 times as long as broad; X slightly broader and distinctly longer than IX, 1.8 times as long as broad; XI slightly broader than X, much shorter than IX–X together.

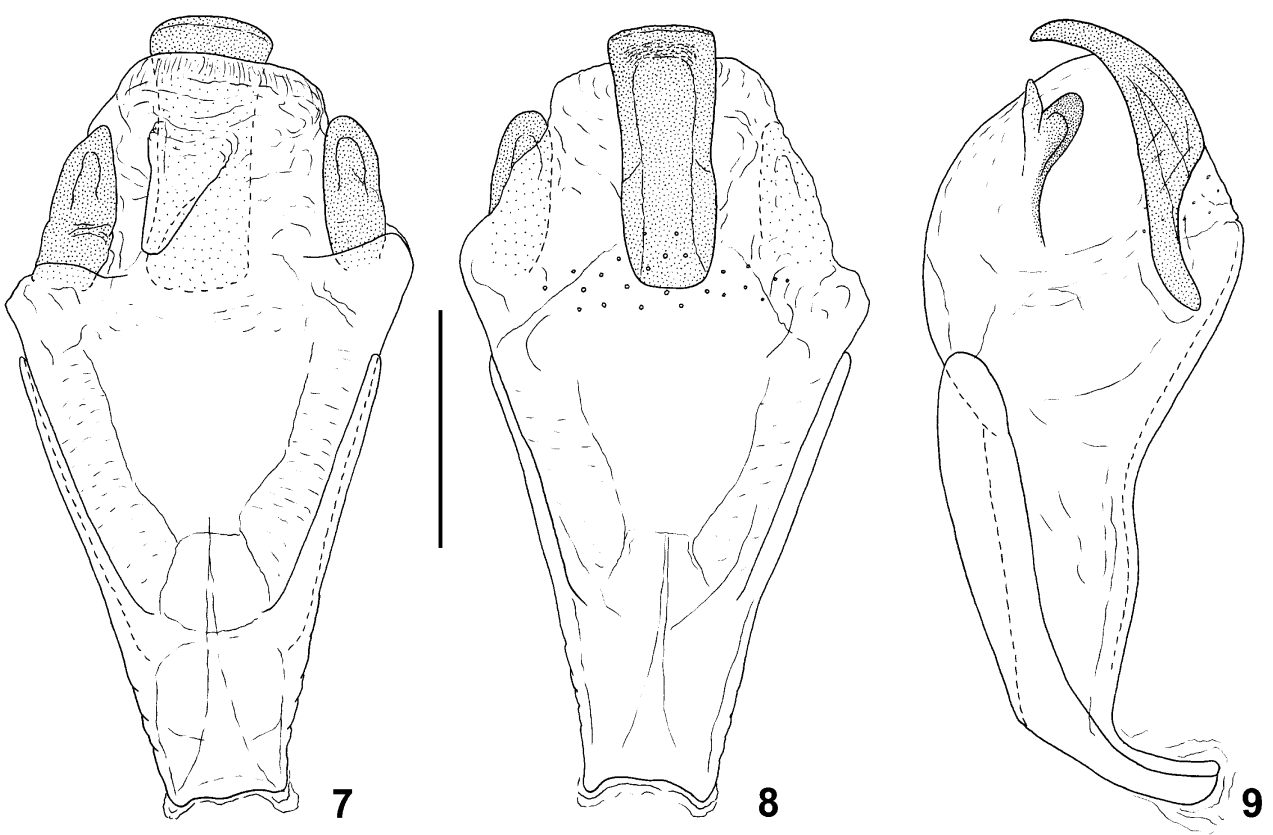
Pronotum elongate in dorsal view, subtrapezoidal, broadest in anterior third, length 0.50 mm, width 0.46 mm; anterior margin broadly and distinctly rounded; lateral margins distinctly rounded in anterior third, straight in posterior two-thirds, distinctly convergent towards slightly obtuse, blunt hind angles; posterior margin arcuate; base with distinct transverse groove which is disrupted in the middle by a narrow median longitudinal carina slightly longer than one-third of pronotal length; carina constricted at crossing with the transverse groove, lateral ends of groove deepened and anteriorly bent forming lateral grooves which are parallel to lateral margins of pronotum, about one-third of pronotum length. Punctures on pronotal disc moderately large, very shallow and slightly irregular in shape, so that surface of cuticle appears uneven; setae moderately long, sparse, suberect.

Elytra oval, broadest between middle and anterior third, length 1.25 mm, width 0.85 mm, elytral index 1.47. Humeral calli clearly marked as elongate, longitudinal wrinkles; basal pit on each elytron moderately large, much closer situated to scutellum than to humerus; suture in anterior one-sixth of elytra distinctly raised; elytral apices separately rounded; each elytron bearing an extremely small, barely discernible pore on subapical region, surrounded by slightly raised cuticle, and separated from elytral apex by a space as long as about three pore diameters, and from suture by a space slightly longer than pore diameter. Punctures on elytra very shallow, diffused, moderately large, separated by spaces 1.5 times as long as puncture diameters; setae similar to those on pronotum, but slightly thicker.

Hind wings well-developed, functional.

Legs very long and slender, without modifications.

Aedeagus (Figs. 7–9) 0.33 mm in length, relatively slender, with very long and narrow subrectangular median apical plate, and short lateral apical plates; parameres long and slender, with rounded apices.



Figs. 7–9. *Neuraphes qinghaiensis* n. sp., aedeagus in dorsal (7), ventral (8), and lateral (9) views. – Scale: 0.1 mm.

Diagnosis

This large species of *Neuraphes* belongs to a Far Eastern group sharing a distinctly bicolorous body, with a dark brown, nearly black head and pronotum and much lighter, reddish-brown elytra. It differs from all similar congeners in having extremely long antennae which are equal in length to the elytra, and all antennomeres being much longer than broad. Furthermore, the subapical pore on each elytron, a secondary sexual structure found in males in this poorly known species group, is extremely small in *N. qinghaiensis*, surrounded by only slightly raised cuticle, so that it is barely visible under 80 times magnification. This pore is large and located on a diffused but distinct tubercle in the remaining species of this lineage, and is always easily recognizable under 40 times magnification. A combination of the very slender and long median apical plate with short lateral plates in the aedeagus is also not found in any other Himalayan and sub-Himalayan *Neuraphes*.

Remarks

An interesting and unique character of *N. qinghaiensis* is a pair of very shallow impressions on the vertex located in a similar place where the foveae in *Neuraphes* s. str. are developed. The presence or lack of these pits is the only diagnostic character differentiating the subgenera in *Neuraphes*. However, the foveae in *Neuraphes* s. str. are deep, and they are not tentorial pits but possibly openings of glands (the pits are connected to a subcuticular cluster of vesicular structures, according to observations of the author). The pits in the newly described species are very shallow and seem to be rather well-defined impressions. Besides, very similar Himalayan and Far Eastern species are known (*N. jumlanus*, *N. himalayanus*, *N. khumbuanus*, *N. tibetanus*, and *N. niponensis* Franz, 1976), which share with *N. qinghaiensis* the general body form, the bicolorous pigmentation, male secondary sexual characters, and structures of the aedeagus; but none of these bearing pits on the vertex. Therefore, *N. qinghaiensis* is placed in the subgenus *Pararaphes*. However, a more comprehensive study is necessary to clarify the functional importance of the foveae on the head of *Neuraphes* and to validate the current, traditional views on the evolution of the genus reflected by the existing subgeneric division.

3 References

JAŁOSZYŃSKI, P. (2008): Revision of *Neuraphes* Thomson of the Himalaya Mts. (Coleoptera: Scydmaenidae). Genus, Wrocław **19**: 619–637.

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Revision of the genus *Amarygmus* Dalman and related genera. LII. A new species and faunistic records of *Amarygmus* from the Northern Moluccas (Coleoptera: Tenebrionidae: Amarygmini)

Hans J. Bremer

Abstract

A new species, *Amarygmus ventricosus* **n. sp.** (Coleoptera: Tenebrionidae: Amarygmini) from the Northern Moluccas/Indonesia (Morotai and Halmahera), is described and illustrated. Faunistic records of eight other species of *Amarygmus* from the Northern Moluccas are given.

Keywords: Coleoptera, Tenebrionidae, *Amarygmus*, new species, Northern Moluccas, faunistic records.

Zusammenfassung

Eine neue Art, *Amarygmus ventricosus* **n. sp.** (Coleoptera: Tenebrionidae: Amarygmini) von den nördlichen Molukken/Indonesien (Morotai und Halmahera) wird beschrieben und abgebildet. Funddaten von acht anderen *Amarygmus*-Arten von den nördlichen Molukken werden aufgelistet.

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1 Introduction

The Northern Moluccas consist mainly of the Indonesian islands of Halmahera, Ternate, Bacan und Morotai. The Tenebrionidae of that archipielago, including species of the genus *Amarygmus* Dalman, 1823, are insufficiently known. This is probably due to insufficient collecting activities.

Pic (1915) described *Amarygmus batjanensis* (Pic, 1915) [syn. *A. testaceicornis* (Pic, 1915)] from the Northern Moluccas. Gebien (1920) reported the occurrence of *A. cuprarius iodicollis* Guérin-Méneville, 1830 from Ternate, Bacan, Halmahera and Watubella Islands, and of *A. orientalis* (Fairmaire, 1883) from Bacan. Bremer (2003, 2008) described *A. grimmi* Bremer, 2003 from Halmahera and *A. venetus* Bremer, 2008 from Bacan and Halmahera. Considering the great number of species of *Amarygmus* on the neighbouring islands of Sulawesi and the Central and Southern Moluccas, it would be surprising that the islands of the Northern Moluccas should have fewer species.

During the past years A. Riedel, A. Skale and A. Weigel used short stays on these islands to collect some Tenebrionidae. Due to their activities one new *Amarygmus* was collected which is described in this paper. A second, probably new species is severely damaged so that I cannot describe it. In addition, collection data of *Amarygmus* of this area are presented, which were determined by me during the last years. It is highly probable that systematic collections on these islands would considerably increase the number of tenebrionid species (including *Amarygmus*).

Abbreviations

CG	Collection of Dr. R. Grimm, Tübingen, Germany
CS	Collection of A. Skale, Hof/Saale, Germany
CW	Collection of A. Weigel, Wernburg, Germany
MNHN	Muséum National d'Histoire Naturelle, Paris
NME	Naturkundemuseum Erfurt, Germany
SMNS	Staatliches Museum für Naturkunde, Stuttgart, Germany
HNHM	Hungarian Natural History Museum, Budapest, Hungary
UWP	Primary forest
UWS	Secondary forest
ZSM	Zoologische Staatssammlung, Munich, Germany
ZSMB	Collection of the author, now property of the Zoologische Staatssammlung, Munich, Germany

Acknowledgments

I thank Dr. W. Schawaller (SMNS) for the trustful loan of the specimen described in this paper. My thanks also go to A. Skale (Hof/Saale) and A. Weigel (Wernburg) for their permis-

sion to examine their material of *Amarygmus* and to retain some specimens. In addition, I thank Mr. F. FORMAN (Stemwede) for preparing the drawings of the new species. Thanks are extended to Dr. R. GRIMM (Tübingen) and Dr. W. SCHAWALLER for the review of the manuscript.

2 Morphometry

"Body length" represents the distance between the middle of anterior edge of the pronotum and the apices of the elytra; "body width" the maximum width across the elytra; "length of elytra" the distance between the base of the scutellum and the apices of the elytra; "length of pronotum" the distance between the middle of their anterior and posterior edges.

3 Description of the new species

Amarygmus ventricosus **n. sp.**
(Fig. 1A–H)

Holotype (♂): Indonesia, Maluku, Is. Morotai, W Daruba, Raja, 19.XI.1999, 50–300 m, leg. A. RIEDEL (SMNS).

Paratypes: Indonesia, Halmahera NW, 21 km N Jailolo, Goal Village, 100 m, 1°14'11"N 127°32'10"E, 23.I.2006, leg. A. SKALE, plantage, river side (1 ♀ CS, 1 ♂ ZSMB) (both paratypes more or less damaged).

Etymology

Ventricosus (Lat.) = big-bellied.

Diagnosis

Small, winged; with a small pronotum and broad elytra. Head, pronotum and elytra black, this colouration is contrasting with the yellowish brown legs. Elytra with rows of medium-sized punctures. Width of frons medium; antennae long.

A. ventricosus resembles in size and shape *A. caelebs* Bremer, 2004 (BREMER 2004b: 50–52) from northern Sulawesi. However, *A. caelebs* is wingless while *A. ventricosus* possesses wings; *A. caelebs* has striae on the elytra, *A. ventricosus* rows of closely set punctures; the antennae of *A. caelebs* are long, but in *A. ventricosus* the antennomeres are longer and more slender than in *A. caelebs*; frons and clypeus of *A. caelebs* are less densely punctured than in *A. ventricosus*.

Description

Measurements: Body length 4.55–5.14 mm; body width 3.21–3.27 mm. – Ratios: Pronotum: width/length 1.65–1.71; width hind corners/width front corners 1.56–1.60. Elytra: length/width 1.16–1.22; length elytra/length pronotum 2.82–3.17; maximum width elytra/maximum width pronotum 1.47–1.51.

Colouration: Head, pronotum and elytra black and slightly opaque; legs and antennomeres 1+2 yellowish brown, antennomeres 3–11 dark brown to black. Underside dark brown, its colouration contrasting with the yellowish femora.

Head: Frons of median width; width corresponding to length of antennomere 3; with indistinct, small punctures. Genae raised, anteriorly terminating at the level of the fronto-clypeal suture. Fronto-clypeal suture slightly incised, bent. Clypeus stretched forwards, somewhat convex; size and density of punctures on clypeus similar to those on frons.

Pronotum: Relatively narrow, markedly convex transversely and longitudinally. Sides bent, with maximum width in the middle, narrowing towards the rounded hind corners and the acute front corners. Anterior margin excavated. Sides and anterior margin bordered. Lateral margins in dorsal view very narrowly visible only in the posterior halves. Front corners rectangular in lateral view, hind corners clearly obtuse. Surface with indistinct, sparse, tiny punctures.

Scutellum: Triangular, without punctures.

Elytra: Ovate, markedly convex. Maximum height and width somewhat anterior to middle. Shoulders not prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view visible only at shoulders and apex. With rows of medium-sized punctures which are sometimes situated in slightly impressed rows; in row 4 approximately 42 punctures; punctures of the rows indistinct at the apex. Intervals either slightly convex or flat, with tiny, sparse punctures.

Prosternum: Short. Anterior margin continuously bent upwards. Apophysis short, slightly longer than wide (2.4 : 1.8); lateral margins rounded and raised ventrad; median space in between with a relatively broad and deep groove; apex straight, surface with some short hairs.

Mesosternum: Anterior margin scarcely excavated in the middle; covered with medium-sized punctures and short hairs.

Metasternum: Anterior half with closely set medium-sized punctures, posterior half with much smaller punctures. Medium line slightly incised.

Sternites: Disc of sternite 1 with a few small punctures; sternites 2–5 with a few, extremely small punctures. Sternite 5 apicomedially without sexual characters in the males.

Antennae: Very long, reaching posterior fourth of elytra. Length/width ratio of antennomeres 1–11 equals to 20:8 / 8:6 / 22:6 / 16:6 / 20:6 / 17:6 / 20:6½ / 22:6½ / 20:7 / 20:7 / 23:8.

Legs: Relatively long. Femora slightly thickened towards the second third. Pro- and mesotibiae approximately straight; metatibiae straight but their apical fifth slightly incurved. Protarsomeres 1–3 slightly widened and prolonged in males. Lengths of protarsomeres 1–5 in a male as 10:9:7:6:23, lengths of mesotarsomeres 1–5 as 13:9:7:6:23, lengths of metatarsomeres 1–4 as 38:14:5:22.

Aedeagus: See Fig. 1F–H.

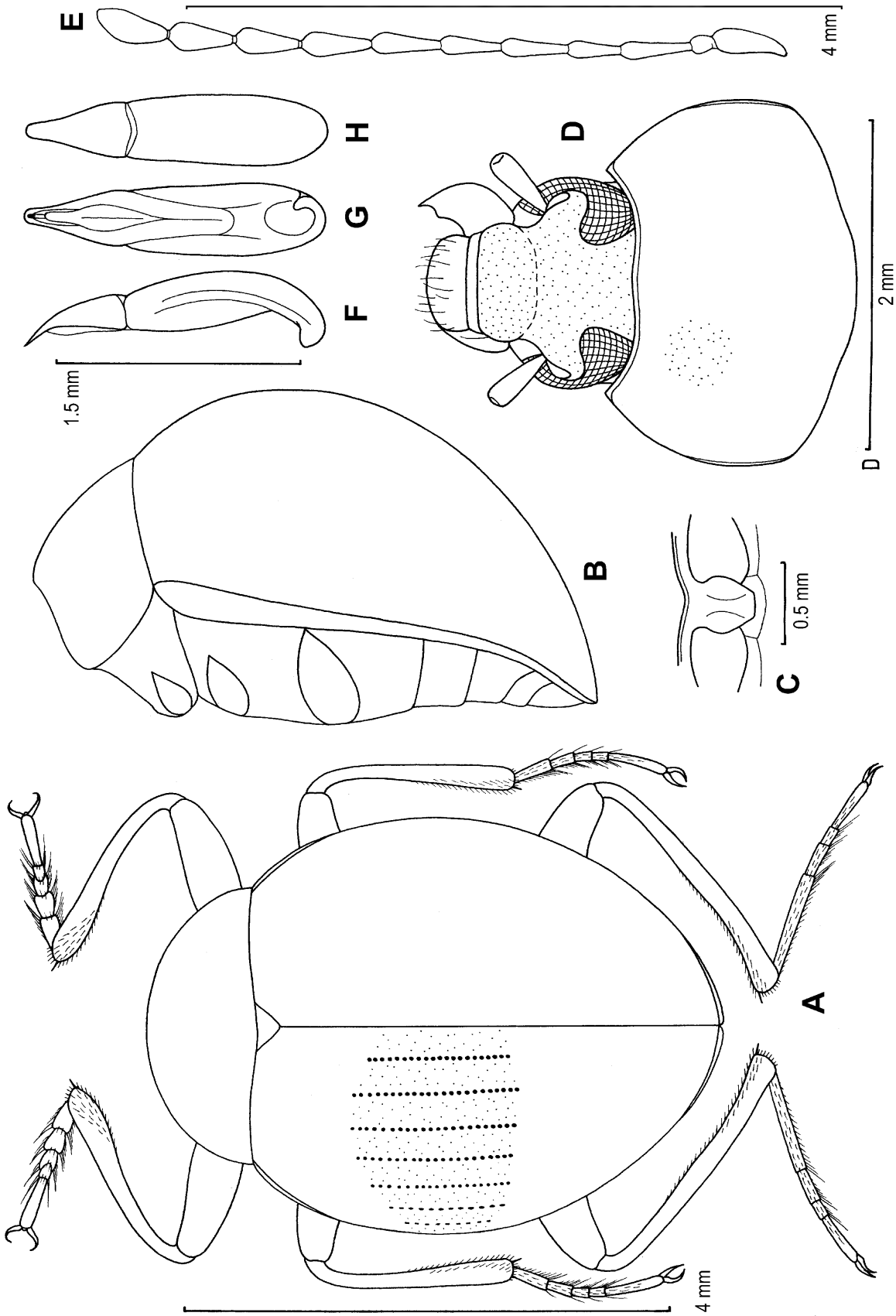

Fig. 1. *Amarygmus ventricosus* n. sp. – **A** Habitus, ♂. **B** Body, lateral view. **C** Prosternal apophysis. **D** Head and pronotum. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

Remarks

A similar specimen from Bacan Island ["N.-Molukken, Bacan, 10 km E Labuha, 120 m, 0°38'07"N 127°34'48"E, 14.I.2006, leg. A. SKALE, UWP + plantage"] possesses slightly longer elytra and is more lustrous. Unfortunately, this specimen is very damaged. Therefore, I cannot decide whether it is a subspecies or a variety of *A. ventricosus* n. sp.

4 Records of other species of *Amarygmus* from the Northern Moluccas

The data on the labels are given in the original language and with the abbreviations used by the collectors.

Amarygmus batjanensis (Pic, 1915)

Material

Bacan: Ins. Batjan (holotypes of *D. batjanensis* and *D. testaceicornis*, MNHN). – N.-Molukken, Bacan, 10 km E Labuha, 120 m, 0°38'07"N 127°34'48"E, 14.I.2006, leg. A. SKALE, UWP + plantage (1 CS). – N.-Molukk., Bacan, Labuha, Hotel "Buana Lipu", 0°39.0'N 127°29.6'E, 12.I.2006, leg. A. WEIGEL, plantage (2 NME, 1 ZSMB). — Halmahera: Maluku, Is. Halmahera, Sidangoli, Batu Putih, 22.–23.XI.1999, 100 m, leg. A. RIEDEL (1 SMNS). – Halmahera, 2–3 km N Dolik, Dolik River, 0°15'49"N 127°42'40"E, 18.–28.I.2006, leg. A. SKALE (2 CS, 1 ZSMB; specimens severely damaged). — Ternate: Molucc., Ternate (2 ♀♀ HNHM).

Redescription, illustration and synonyms see BREMER (2004a: 126–128).

Distribution: Presently only known from Bacan, Halmahera, and Ternate.

Amarygmus cuprarius iodicollis Guérin-Méneville, 1830

Material

Bacan: Bacan, 10 km E Labuha, 120 m, 1°38'07"N 127°34'48"E, 14.I.2006, leg. A. SKALE (3 CS). — Halmahera: Halmahera, 2–3 km N Dolik, 0°15'49"N 127°42'40"E, 18.–20.I.2006, leg. A. SKALE (1 CS). – Halmahera NW, 21 km N Jailolo, Goal Village, 100 m, 1°14'11"N 127°32'10"E, 23.I.2006, leg. A. WEIGEL (1 NME).

Synonyms see BREMER (2001: 198).

Distribution: Australia, Solomon Islands, New Guinea, Central and the Northern Moluccas.

Amarygmus dotalis Bremer, 2003

Material

Halmahera: Halmahera, 2–3 km N Dolik, 0°15'49"N 127°42'40"E, 18.–20.I.2006, leg. A. SKALE (1 ♀ ZSM). – Halmahera, 2–3 km N Dolik, Dolik River, 0°15'49"N 127°42'40"E, 18.I.2006, leg. A. WEIGEL, plantage and UWS (1 ♀ CW). – Indonesia, Halmahera NW, 7 km S Jailolo, 200 m, 1°1'18"N 127°31'39"E, 26.–27.I.2006, leg. A. SKALE, UWP + clearings (1 ♀ CS).

Remarks

This is a small, elongate species which was previously known only from Ceram (Central Moluccas). The specimens from Halmahera are smaller in average than those from Ceram, but I do not recognize other characters which could separate them. Unfortunately, all specimens from Halmahera and from Ceram are females, therefore the aedeagi remain unknown.

The size of the punctures of the striae and maximum width of the elytra are relatively heterogenous within the specimens from Halmahera.

Body length of the specimens from Ceram 4.20 + 4.53 mm, body width 2.09 + 2.19 mm. Body length of the specimens from Halmahera 3.85–4.36 mm, body width 1.91–2.24 mm.

Amarygmus grimmi Bremer, 2003

Material

Halmahera: NE Halmahera, Umg. LabiLabi, ca. 5 km östlich, 1°27'60,8"N 129°22'04,5"E, 0–200 m, 20.V.–2.VI.1997, leg. M. HIERMEIER (holotype ♂ CG). – Halmahera, 2–3 km N Dolik, Dolik River, 0°15'49"N 127°42'40"E, 18.–20.I.2006, leg. A. SKALE (1 ZSMB).

Distribution: Known only from Halmahera.

Amarygmus hydrophiloides Fairmaire, 1849

Material

Bacan: Ins. Batjan (2 MNHN). — Halmahera: Halmahera NW, 21 km N Jailolo, Goal Village, 100 m, 1°14'11"N 127°32'10"E, 23.I.2006, leg. A. SKALE (4 CS). – S Tobelo, Togoliua, ca. 200 m, 2.XI.1999, leg. A. RIEDEL (1 SMNS). — Morotai: Morotai, W Daruba, Raja, 50–300 m, 16.–19.XI.1999, leg. A. RIEDEL (2 SMNS).

Redescription, illustration and synonyms see BREMER (2008: 75–76).

Distribution: Fiji, Samoa, Wallis and Tonga-Tabou Islands, Woodlark Island, several islands of Micronesia, New Zealand (?), Australia, Solomon Islands, Bismarck Archipelago, New Guinea, the Moluccas (including Aru Islands and Kai [= Key] Islands), Madagascar (?), Sri Lanka (BREMER 2007b: 45).

Amarygmus morio (Fabricius, 1775)

Material

Morotai: Morotai, W Daruba, Raja, 50–100 m, 16.–19.XI.1999, leg. A. RIEDEL (3 SMNS, 1 ZSMB).

Redescription, illustration and synonyms see BREMER (2005: 43–48).

D i s t r i b u t i o n : Hawai'i, Fiji, Solomon Islands, Bismarck Archipelago, Australia, New Guinea, Aru-Islands, Key Islands, Ceram, Buru, Morotai, Sulawesi.

Amarygmus orientalis (Fairmaire, 1883)

Material

M o r o t a i : Morotai, W Daruba, Raja, 50–100 m, 16.–19.XI.1999, leg. A. RIEDEL (3 SMNS, 1 ZSMB).

Redescription, illustration and synonyms see BREMER (2007a: 23–26).

D i s t r i b u t i o n : New Hebrides, Bismarck Archipelago, New Guinea, the Moluccas (Ambon, Pulau Saparua, Buru, Morotai).

Amarygmus venetus Bremer, 2008

Material

B a c a n : Bacan, Labuha, 0°38'N 127°29.6'E, 12.I.2006, leg. A. SKALE (holotype ♂ ZSM; paratypes 1 ♀ 1 ♂ CS). – Same data as before, but leg. A. WEIGEL (paratype 1 ♀ NME). — H a l m a h e r a : Halmahera, 2–3 km N Dolik, 0°15'49"N 127°14'42"E, 18.–20.I.2006, leg. A. SKALE (paratype 1 ♀ CS).

D i s t r i b u t i o n : Bacan, Halmahera.

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Revision of the genus *Amarygmus* Dalman and related genera. LVI. The Amarygmini of Borneo (Coleoptera: Tenebrionidae), part I

Hans J. Bremer

Abstract

The present paper is the first part of a revision of all genera and species of Amarygmini of Borneo. General remarks on Amarygmini and in particular on the genus *Amarygmus* are given. A key to the genera of Amarygmini of Borneo is provided.

Newly described genera, species and subspecies: *Seorsoplonyx antennatus* **n. gen.**, **n. sp.** (Sabah, Kalimantan), *Sylvanoplonyx femoralis* **n. gen.**, **n. sp.** (Sabah), *Amarygmus abortivus* **n. sp.** (Sabah), *A. adornatus* **n. sp.** (Sabah), *A. aeris* **n. sp.** (Sabah), *A. affectus* **n. sp.** (Sarawak), *A. assessorius* **n. sp.** (Sabah), *A. assignatus* **n. sp.** (Sabah), *A. catenatus* **n. sp.** (Sabah), *A. cephalotes* **n. sp.** (Sabah, Kalimantan, South Thailand), *A. coccinelloides* **n. sp.** (Sabah), *A. cyamias* **n. sp.** (Sabah), *A. cyaneicollis* **n. sp.** (Sabah), *A. cyclaeus* **n. sp.** (Sabah, Sarawak), *A. delicatulus* **n. sp.** (Sabah), *A. disgregatus* **n. sp.** (Sabah, Sarawak), *A. emasensis* **n. sp.** (Sabah), *A. erilis* **n. sp.** (Kalimantan), *A. eureos* **n. sp.** (Sabah), *A. expeditus* **n. sp.** (Sabah, Sarawak), *A. gnitus* **n. sp.** (Sabah), *A. inconditus* **n. sp.** (Sarawak, Sabah), *A. iunctus* **n. sp.** (Sarawak, Sabah), *A. (Pyanirygmus) magnus* **n. sp.** (Sabah), *A. medius* **n. sp.** (Sabah, Sarawak, Kalimantan), *A. muluensis* **n. sp.** (Sarawak), *A. murutensis* **n. sp.** (Sabah), *A. neso* **n. sp.** (Sarawak), *A. nitens glabratus* **n. ssp.** (Sarawak), *A. novior* **n. sp.** (Sabah), *A. nuntius* **n. sp.** (Sarawak, Singapore), *A. nyctelius* **n. sp.** (Sabah), *A. platypodes* **n. sp.** (Sabah), *A. poringensis* **n. sp.** (Sabah), *A. praecellens* **n. sp.** (Sarawak), *A. proteus* **n. sp.** (Sarawak, Singapore), *A. pygmaeus* **n. sp.** (Sabah), *A. rolandi* **n. sp.** (Sabah), *A. sarawakensis* **n. sp.** (Sarawak, Malayan Peninsula), *A. singulus* **n. sp.** (Sabah), *A. tantillus* **n. sp.** (Sabah), *A. urbanus* **n. sp.** (Sabah, Sarawak), *A. verecundus* **n. sp.** (Sabah), *A. vespertinus* **n. sp.** (Sabah), *A. viduatus* **n. sp.** (Sarawak), *A. vilis* **n. sp.** (Sabah), *A. viridis* **n. sp.** (Sabah), *A. votivus* **n. sp.** (Sabah).

Keywords: Coleoptera, Borneo, Tenebrionidae, Amarygmini, *Amarygmus*, *Seorsoplonyx*, *Sylvanoplonyx*, revision, new genera, new species.

Zusammenfassung

Diese Arbeit ist der erste Teil einer Revision aller Gattungen und Arten der Amarygmini von Borneo. Es werden allgemeine Angaben zu den Amarygmini und vor allem der Gattung *Amarygmus* gemacht. Eine Bestimmungstabelle der Gattungen der Amarygmini von Borneo ist angefügt.

Neu beschriebene Gattungen, Arten und Unterarten: *Seorsoplonyx antennatus* **n. gen.**, **n. sp.** (Sabah, Kalimantan), *Sylvanoplonyx femoralis* **n. gen.**, **n. sp.** (Sabah), *Amarygmus abortivus* **n. sp.** (Sabah), *A. adornatus* **n. sp.** (Sabah), *A. aeris* **n. sp.** (Sabah), *A. affectus* **n. sp.** (Sarawak), *A. assessorius* **n. sp.** (Sabah), *A. assignatus* **n. sp.** (Sabah), *A. catenatus* **n. sp.** (Sabah), *A. cephalotes* **n. sp.** (Sabah, Kalimantan, südliches Thailand), *A. coccinelloides* **n. sp.** (Sabah), *A. cyamias* **n. sp.** (Sabah), *A. cyaneicollis* **n. sp.** (Sabah), *A. cyclaeus* **n. sp.** (Sabah, Sarawak), *A. delicatulus* **n. sp.** (Sabah), *A. disgregatus* **n. sp.** (Sabah, Sarawak), *A. emasensis* **n. sp.** (Sabah), *A. erilis* **n. sp.** (Kalimantan), *A. eureos* **n. sp.** (Sabah), *A. expeditus* **n. sp.** (Sabah, Sarawak), *A. gnitus* **n. sp.** (Sabah), *A. inconditus* **n. sp.** (Sarawak, Sabah), *A. iunctus* **n. sp.** (Sarawak, Sabah), *A. (Pyanirygmus) magnus* **n. sp.** (Sabah), *A. medius* **n. sp.** (Sabah, Sarawak, Kalimantan), *A. muluensis* **n. sp.** (Sarawak), *A. murutensis* **n. sp.** (Sabah), *A. neso* **n. sp.** (Sarawak), *A. nitens glabratus* **n. ssp.** (Sarawak), *A. novior* **n. sp.** (Sabah), *A. nuntius* **n. sp.** (Sarawak, Singapur), *A. nyctelius* **n. sp.** (Sabah), *A. platypodes* **n. sp.** (Sabah), *A. poringensis* **n. sp.** (Sabah), *A. praecellens* **n. sp.** (Sarawak), *A. proteus* **n. sp.** (Sarawak, Singapore), *A. pygmaeus* **n. sp.** (Sabah), *A. rolandi* **n. sp.** (Sabah), *A. sarawakensis* **n. sp.** (Sarawak, Malaysische Halbinsel), *A. singulus* **n. sp.** (Sabah), *A. tantillus* **n. sp.** (Sabah), *A. urbanus* **n. sp.** (Sabah, Sarawak), *A. verecundus* **n. sp.** (Sabah), *A. vespertinus* **n. sp.** (Sabah), *A. viduatus* **n. sp.** (Sarawak), *A. vilis* **n. sp.** (Sabah), *A. viridis* **n. sp.** (Sabah), *A. votivus* **n. sp.** (Sabah).

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1 Introduction

Borneo, Sumatra, Java (and adjacent islands), together with the countries of the Malayan Peninsula (Malaysia, Sinpapore, southern Thailand), form a faunistic area in which numerous genera of Amarygmini occur: *Amarygmus* Dalman, 1823, *Azarelius* Fairmaire, 1892, *Cephalamarygmus* Bremer, 2001, *Cerysia* Bremer, 2001, *Eumolpocyriogeton* Pic, 1922, *Euspinamarygmus* Masumoto, 1989, *Macrosynopticus* Pic, 1922, *Gonocnemis* Thomson, 1858, *Javamarygmus* Pic, 1928, *Paragonocnemis* Kraatz, 1899, *Plesiophthalmus* Motschulsky, 1857, and *Pontianacus* Fairmaire, 1898.

Newly described species unconsidered, I currently know from Borneo 94 species of *Amarygmus*, one species of *Azarelius*, one species of *Cephalamarygmus*, two species of *Cerysia*, two species of *Eumolpocyriogeton*, one species of *Euspinamarygmus*, four species of *Gonocnemis*, one species of *Javamarygmus*, one species of *Macrosynopticus*, two species of *Paragonocnemis*, 12 species of *Plesiophthalmus*, and one species of *Pontianacus*.

An additional genus, *Barlacus* Fairmaire, 1900, could possibly belong to Amarygmini (with *B. costulatus* Fairmaire, 1900 known from Borneo). Gebien (1943) assigned this genus to Rhysopaussini. All genera of Rhysopaussini which were already studied (Ardoin 1962–1969, Bremer 1991) belong to Amarygmini, but the systematic position of *Barlacus* has not been classified yet.

The aim of the present paper and the following planned ones is a critical evaluation of all genera and species of the Amarygmini of Borneo, including descriptions of new taxa and determination keys to genera and species. The combined contributions are intended to be a monograph. This first part contains general remarks on Amarygmini and the genus *Amarygmus*, a determination key to the genera of Amarygmini from Borneo, the descriptions of two new genera and species, and descriptions of 46 new species of *Amarygmus*. I have currently more than 20 undescribed *Amarygmus* at hand from Borneo, thus another paper with descriptions of new species will follow soon.

There was no revision of Amarygmini of Borneo except several papers of Masumoto (1988a–1991b, 1999, 2001) on genera near *Plesiophthalmus*. Many species of *Amarygmus* from Borneo (and from other Greater Sunda Islands and Malayan Peninsula) have already been described, usually as isolated descriptions. A great number of them has been published without mentioning the essential characters, without a comparison with related species, and without detailed illustrations. During the last years I evaluated the types of nearly all species of this region and provided redescriptions and illustrations of inadequately described species (Bremer 2001b, d; 2002a–c; 2003a, b; 2004a, d, e; 2005a–e; 2006a, b, d; 2007a; 2009). Thus, a comprehensive treatment of the Amarygmini of Borneo is now possible and also necessary because of the large number of already described and still undescribed species.

Numerous species from Borneo also occur on the Malayan Peninsula and on other Greater Sunda Islands, most probably caused by land bridges between these areas which were existing until the last glacial period. The separate treatment of the species of Borneo, excluding species known from the Malayan Peninsula and other Greater Sunda Islands, is due to practical reasons. The treatment of all Amarygmini of the whole faunistic area would greatly extend the size of any publication. Additionally, the species of Sumatra and of the Malayan Peninsula are not as well investigated as those of Borneo. The *Amarygmus* and *Cephalamarygmus* species of Java have been listed recently (Bremer 2007b). Subsequent work of the Amarygmini of the Malayan Peninsula and Sumatra can benefit from the diagnoses included in this and the following papers.

While many species of Borneo also occur on other Greater Sunda Islands and on the Malayan Peninsula, there are only a few species which are also present on Sulawesi. This was demonstrated by Bremer (2004b, c) for *Cerysia celebensis* (Blair, 1929), *Amarygmus metallicus* (Perty, 1831), *Amarygmus micans* (Fabricius, 1794), *Amarygmus cuprarius cuprarius* (Weber, 1801), and *Amarygmus nigrofasciatus* Pic, 1915.

It is also striking that several taxa of northern Thailand, northern Laos, and northern Vietnam have very similar and probably nearly related forms on Borneo, e. g. *Amarygmus cupreofossus* Fairmaire, 1888 and *A. ertli* Bremer, 2005, *A. cyanescens* Pic, 1926 and *A. borneensis* (Gebien, 1920), and *A. decorosus* Bremer, 2003 and *A. iunctus* n. sp. (species of Thailand, Laos and Vietnam mentioned first).

Abbreviations of depositories

BMNH	Natural History Museum, London, U. K.
CA	Collection of Dr. Kiyoshi Ando, Osaka, Japan
CG	Collection of Dr. Roland Grimm, Tübingen, Germany
CKB	Collection of Karol Bohrn, Bratislava, Slovakia
CM	Collection of Prof. Dr. Kimio Masumoto, Tokyo, Japan
HNHM	Hungarian Natural History Museum, Budapest, Hungary
MHNG	Muséum d'Histoire Naturelle, Genève, Switzerland
MNHN	Muséum National d'Histoire Naturelle, Paris, France
NSMT	National Science Museum (Natural History), Tokyo, Japan
SMNS	Staatliches Museum für Naturkunde, Stuttgart, Germany
SSB	Collection of Stanislav Bečvář, České Budějovice, Czech Republic
ZMHB	Museum für Naturkunde, Berlin, Germany
ZSMB	Collection of the author, now property of the Zoologische Staatssammlung, Munich, Germany

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K. BOHRN (Bratislava), A. FOUQUÈ (Liberec), Dr. C. GIRARD (Paris), Dr. R. GRIMM (Tübingen), Prof. Dr. K. MASUMOTO (Tokyo), Dr. O. MERKL (Budapest), Dr. W. SCHAWALLER (Stuttgart), Dr. E. SPRECHER (Basel), and Dr. M. UHLIG (Berlin).

My particular thanks are due to Dr. R. GRIMM (Tübingen) who essentially contributed to this work. The material which was collected by him turned out to be extremely rich in species and specimens. Dr. GRIMM also provided valuable information on the circumstances of collection.

Thanks are extended to Dr. R. GRIMM and Dr. W. SCHAWALLER for the review of the manuscript.

Most of the drawings of this paper have been prepared by F. FORMAN (Stemwede), Germany; the habitus of *Pontianacus rubricrus* Fairmaire was drawn by J. PÁL (Budapest). The figures were scanned by J. REIBNITZ (Stuttgart).

2 Materials and Methods

Materials

For the present study I received extensive material from Dr. R. GRIMM (Tübingen), collected by him in Sabah and Sarawak during the last years. A large number of specimens have also been provided by Dr. W. SCHAWALLER (Stuttgart), by my son ULF BREMER (formerly Kota Kinabalu), and by the collecting activities of several other colleagues. I received the latter material mainly via Dr. K. ANDO (Osaka), M. V. L. BARCLAY (London), Prof. Dr. K. MASUMOTO (Tokyo), and S. BEČVÁŘ (České Budějovice). Additionally I used many specimens from my former collection (now property of the Zoologische Staatssammlung, Munich).

Morphometry

"Body length" represents the distance between the middle of anterior edge of the pronotum and the apices of the elytra; "body width" the maximum width across the elytra; "length of elytra" the distance between the base of the scutellum and the apices of the elytra; "length of pronotum" the distance between the middle of their anterior and posterior edges.

Data on the labels

The data on the labels are given in the original language and with the abbreviations used by the collectors.

3 General remarks on Amarygmini and *Amarygmus*

Habitat

Knowledge on pre-imaginal stages and habitat use of Amarygmini of the Oriental faunal area is rudimentary. No larvae of species from Borneo have ever been described, and no larval development was ever observed. However, from the circumstances of collection of the adults (see the material parts of the described species below) it appears likely that wooden or fungous material may serve as a suitable substrate for the development of the larvae. After what is known, probably all species are nocturnal.

How to collect Amarygmini

The majority of species can be found at night on the bark of living and dead trees or on dead wood, especially when covered or mixed with fungi or lichen. The beetles are collected on avenue trees or in parks and gardens of urban areas, but also in primary and secondary forests, especially at their edges. They are rarely found under tree bark, in or near boreholes of insects on trees, or in moss or decayed wooden material from which they may be sieved.

Only a few genera or species groups have been recorded as attracted by light, e. g. various *Amarygmus*, above all the oblong *Amarygmus* species which formerly had been assigned to *Elixota* Pascoe, 1866 (e. g. *Amarygmus blanchardi* Bremer, 2001), or species of the genera *Gonocnemis*, *Paragonocnemis*, and *Plesiophthalmus*. However, the attractiveness of light cannot be simply generalized. Among African *Gonocnemis*, e. g., which are better known than the Oriental members of this genus, there are species which are frequently seen at light whereas others are nearly not attracted. The African *Gonocnemis* are associated with termites during their metamorphosis (GIRARD & LAMOTTE 1990, BREMER 1995); this may also be true for Oriental *Gonocnemis*, but comparable observations are lacking. *Cerysia laevicornis* (Blair, 1929) was found together with weaver ants (*Oecophila smaragdina* Fabricius, 1775) on trees at night (observation of Dr. R. GRIMM).

Collection of *Amarygmus* is most effective on trees or other wooden material at night using a torch. However, most species of *Amarygmus* have swollen femora like Alticinae, and like these chrysomelids they usually jump off when disturbed, e. g. when they are hit by the ray of white light of a torch. Usually they remain in their place when the torch emits a certain degree of blue light. The use of a large collection bag is helpful if the beetles jump away.

Determination of Amarygmini

For the identification of Amarygmini the following characters must be examined: Shape, size, density and size of punctures, width of frons (in several species the frons of females is wider than the frons of males), depth of incision of the fronto-clypeal suture, length and shape of antennae (in many species males possess longer antennae than females), shape of legs (including the sexual characters in males), shape of prosternal apophysis, density of punctation of metasternum (in some species closer in males than in females), hairs on legs and underside (in males mostly longer and denser than in females), and also the shape of aedeagus.

Prior to determination a careful cleaning of the insects is frequently necessary. Legs and antennae should be mounted in spread position to allow an easy inspection of their length and shape.

Systematic position and characters of Amarygmini

The definition of the tribe Amarygmini and the delimitation of the genera within this tribe is mainly based on works of LACORDAIRE and ARDOIN. LACORDAIRE (1859: 467–471) separated two groups, Amarygmides and Megacanthides, from the rest of the Tenebrionidae. GISTEL (1856) classified them as Amarygmidae, GEBIEN (1943, 1944) as Amarygmini.

ARDOIN, in his outstanding monography on African Amarygmini (ARDOIN 1962–1969), separated the tribe Amarygmini into the subtribes Amarygmina and Megacanthina which correspond to LACORDAIRE's Amarygmides and Megacanthides. According to ARDOIN the Amarygmina have a wide margin on the anterior border of the pronotum (only visible if the head is removed from the pronotum); in Megacanthina this margin is not developed. All genera found on Borneo belong to Amarygmina.

According to LACORDAIRE (1859) and ARDOIN (1962), the tribe Amarygmini is defined by the combination of the following characters: presence of an unhidden membrane between front margin of clypeus and labrum; base of the aedeagus asymmetric, more or less acutely drawn-out, directed towards the right and fused with the parameres; dorsal side of the aedeagus directed towards the dorsum of the body. A similar asymmetric aedeagal base is also found in Alphitobiini, but this tribe has a hidden membrane between clypeus and labrum.

Remarks on the female genitalia of Amarygmini have been published by ARDOIN (1962: 959), a good illustration of the internal female genitalia of a *Chalcopteroides* species is given by WATT (1989: 120). The shape of defensive glands of Amarygmini is illustrated by TSCHINKEL & DOYEN (1980: fig. 11).

Definitions of the genera of Amarygmini

The generic delimitation of Oriental Amarygmini is unsatisfactory and a matter of ongoing debate. While ARDOIN (1962–1969) presented a more or less convincing concept for Afrotropical genera, a similar work for the Oriental and Papuan-Australian genera is still wanting. Many genera of the Oriental region have been described without a sound differential diagnosis.

Because of the vast number of species, many different morphological adaptations, and widespread sexual dimorphism, it is difficult to find stable characters for a separation of genera. Apart from a few genera which include only one or a few species, there are two extraordinarily species-rich genera, *Amarygmus* and *Plesiophthalmus* which comprise very heterogenous species. One is frequently inclined to separate these genera into smaller entities, but transitional forms make the decision very difficult.

Some genera occurring in Borneo have a wide distributional range and have consequently developed many adapted forms, e. g. the genera *Gonocnemis* and *Paragonocnemis* occurring in the Ethiopian and in the Oriental region, and the genus *Amarygmus* showing a distribution from the eastern coast of Africa up to Hawai'i, with two centres of development, the Greater Sunda Islands and New Guinea, each with an estimated 300 or more species.

Difficulties also exist for assigning species to the genera *Spinamarygmus* Pic, 1915, *Eumolpocyriogeton*, and *Euspinamarygmus*, because these taxa are based on male sexual characters or on the body shape (e. g. "more or less globose"). In my opinion, these genera should either be integrated into an extended genus *Plesiophthalmus* or convincing new characters and definitions must be found for a sound separation. However, my currently restricted knowledge does not allow a decision on this matter. Thus, for practical reasons, the three genera are kept valid for the present paper. Future investigations, based on phylogeny, will hopefully make progress on this question.

Definition of the genus *Amarygmus*

A final genus diagnosis of the genus *Amarygmus* by phylogenetic arguments is still lacking. For example, it is impossible to delimitate several species of *Amarygmus* from those of *Pyanirygmus* Pic, 1915, and of *Pyanirygmus* from those of *Plesiophthalmus* (e. g. most species which could be grouped within *Pyanirygmus* are regarded as *Plesiophthalmus* by YAMAZAKI 1968, MASUMOTO 1990d, MASUMOTO 2001, MASUMOTO et al. 2008). Thus, I give below my opinion on the characters which are necessary to include a species in the genus *Amarygmus*.

Amarygmus Dalman, 1823 is the oldest genus of the Amarygmini. DALMAN (1823) included four species in this genus. These species now belong to two different tribes, one species to *Tetraphyllus* Laporte et Brullé, 1831 [Cnodalonini] (see ANDO 2003), one species to *Chalcopteroides* Strand, 1935, and two species to *Amarygmus* [Amarygmini] (see GEBIEN 1906 and BREMER 2003a). GEBIEN (1920: 410), by subsequent designation, chose *Chrysomela micans* Fabricius, 1794 as type species of this genus. Separation of genera from *Amarygmus* should be based on the characters of this type species.

Sexual dimorphism often occurs and must be considered for taxonomic discussions. Therefore, I had to synonymize the genera *Platolenes* Gebien, 1913 (widening of male protarsomeres 1–3), *Podamarygmus* Carter, 1928 (prolongation of male forelegs), and *Hyperamarygmus* Kaszab, 1964 (widening of male antennomeres 3–5). Another reason for synonymizing these "genera" was the observation that many transitional forms exist between different species with respect to widening of male protarsomeres 1–3 and prolongation of male forelegs. However, I must admit that I used some of these former genera as subgenera with a redefinition (BREMER 2005d), e. g. a subgenus *Podamarygmus* Carter.

The following features or combination of features are considered to be diagnostic for *Amarygmus* (see also key to the genera, chapter 4):

- Apices of the mandibles bifid and not truncate ("truncate" in the sense used here means a straight, single-pointed or rounded apex). Outer surface of mandibles with a longitudinal sulcus which is directed towards the notch of the apex. – On the African continent, e. g., there are many species which, according to the body shape and other characters, belong to *Amarygmus*, but they display rounded apices of their mandibles and not bifid ones. In Australia and New Guinea there are species of *Amarygmus* with a straight or single-pointed apex and species with bifid mandibles. – Probably all genera of Amarygmini from Borneo (including *Amarygmus* and *Azarelius*) have bifid mandibles.
- Lack of a spine, tooth or sharp step anteriorly on the profemora. This character is found in *Amarygmus* and a few similar genera (*Macrosynopticus*, *Javamarygmus*, *Cerysia*, and *Cephalamarygmus*). The femora are usually more or less enlarged in the middle or at the apical third.
- Pronotum without symmetrically grouped humps on pronotum.
- Lack of long, erect hairs on pronotum and elytra (long erect hairs are present in species of the genus *Bunamarygmus* Masumoto, 1988 from Java and Thailand). – Very short recumbent hairs on pronotum and elytra occur in some species of *Amarygmus* (e. g. *A. bryanti* Bremer, 2002, *A. crassicornis* Gebien, 1920). Tiny hairs are visible (at 100-fold magnification) in most *Amarygmus* on the posterior part of the elytra. However, in *Amarygmus* hairs are usually found on clypeus, on legs, on antennomeres and, frequently, as a sexual character of the males on the underside of the body.
- Lack of spots of short hairs on pronotum, elytra and legs (present in *Javamarygmus*).
- Lack of a groove between fronto-clypeal suture and the inner rim of eyes. (Such a deep groove, separating frons from genae, is present in *Cephalamarygmus*).
- Antennomeres 6–10 distinctly separated from each other by a narrow base (filiform and without a narrower base in *Cerysia*).
- Antennomere 11 of usual length, aedeagus not distinctly widened basally, and without hairs dorsally and ventrally on apical part of aedeagus. (*Seorsoplonyx* n. gen. has antennomere 11 very long, the aedeagus wide basally, and tiny hairs dorsally and ventrally on the apical part).

The following characters are not diagnostic for the genus *Amarygmus*:

- Presence or absence of wings: According to my present knowledge all species of *Amarygmus* of Borneo (and of the other Greater Sunda Islands and the Malayan Peninsula) are winged. In neighbouring faunal areas, e. g. Sulawesi and the Philippines, also wingless species occur. There are even species in which winged and wingless specimens occur, e. g. *Amarygmus metallicus* (Perty, 1831) which is always winged on Borneo, but the specimens from Sulawesi and the Moluccas can be winged or wingless.
- Swelling or widening of the femora: In most species of *Amarygmus* the femora are enlarged in the middle or at two-thirds of their length, but the degree of widening differs from species to species.
- Size of the body: The body length differs significantly between species of *Amarygmus* (2–23 mm in species from Borneo).
- Shape of the body: The body shape of species assigned to *Amarygmus* may be very different. It may be globose, short or elongate oval, or oblong with parallel sides of elytra. The apices of the elytra may be mutually rounded or each elytron is individually rounded and slightly retracted towards the suture, e. g. in the frequently occurring *A. metallicus* (Perty, 1831). The front corners of the pronotum may be acutely projecting or rounded (the hind corners are never projecting backwards in genera from the Oriental region).
- Shape of the legs: Legs and metatarsomere 1 vary in length, the tibiae are bent or straight. – In ARDOIN'S (1965) determination key to the genera of Amarygmini the ratio length metatarsomere 1 to length metatarsomeres 2–4 is used for separating *Amarygmus* and the African genus *Paramarygmus* Quedenfeldt, 1885, but it is, indeed, not a useful character because *Amarygmus* shows any intermediate form between a very short metatarsomere 1 and a very long metatarsomere 1.
- Denting or caving in of antennomeres: There are several species in which one or several antennomeres are more or less caved in. In species from Borneo it is mainly antennomere 11. This denting is only visible if the side of denting is exposed. Usually it concerns small species, e. g. *Amarygmus nicholasi* Bremer, 2004 from Borneo. I assume that these species are mainly termitophilous or myrmecophilous and that at the base of these depressions there are glands which excrete substances. In other areas there are species in which several antennomeres have such indentings (e. g. *Amarygmus bacchusi* Bremer, 2001 from New Guinea).

Subgenera of *Amarygmus* in Borneo

With respect to species from Borneo, I currently recognize – besides *Amarygmus* s. str. – only the following two subgenera:

Pyanirygmus Pic, 1915: Pic described this taxon as genus for a very large species, *Pyanirygmus corinthius* Pic, 1915, with long subparallel sides of the elytra and a (in relation to the elytra) narrow pronotum. Many species of *Plesiophthalmus* show these characters as well. However, the profemora of *Pyanirygmus* have no spine or step-like interruption of the anterior outline. There are several Oriental species which belong to this subgenus. The main character of this subgenus is not constant because there are also species with a tendency to an oval shape. Most species of this subgenus are outstanding by its size (body length usually > 15 mm). A redescription and an illustration of *A. (Pyanirygmus) corinthius* Pic, 1915 and a compilation of the other species belonging to this subgenus has been published by Bremer (2005d). *A. (Pyanirygmus) corinthius* Pic, 1915 and other species of this subgenus occur on Borneo.

Podamarygmus Carter, 1928: Carter (1928) erected this genus for species affine *Amarygmus* which possess markedly prolonged male forelegs (type species: *Podamarygmus alternans* Carter, 1928 = *Amarygmus viridipes* Gebien, 1927). However, within the genus *Amarygmus* there are several species with prolonged forelegs which distinctly differ in other characters from *A. viridipes*. It is, e. g., not justified to place *A. viridipes* Gebien, 1927 (from Sumatra, the Malayan Peninsula, and Borneo), *A. tuberculiger* Fairmaire, 1849 (from Fiji), and *A. fasciatus* Gebien, 1913 (from Sumatra, the Malayan Peninsula, and Borneo) into a common genus or subgenus. Moreover, there are other species within the genus *Amarygmus* which show a slight or moderate prolongation of the male forelegs. Thus, this prolongation alone is probably a character of minor importance for separating genera. I have therefore reduced the genus *Podamarygmus* to subgeneric rank within *Amarygmus*, and provided a new definition of this subgenus (Bremer 2006c). The subgenus *Podamarygmus* is characterized by markedly prolonged male forelegs combined with a very wide, apically acute-angled prosternal apophysis (in both sexes); additionally, the species of this subgenus have widened and prolonged male protarsomeres 1–3 which carry long outwardly directed hairs originating from the soles of the tarsomeres, and the surfaces of elytra and prosternum have neither maculae nor are they granulate. *Podamarygmus* contains several small to medium-sized species with an oval body.

4 Key to the genera of the Amarygmini of Borneo

No satisfactory definition of some genera of Amarygmini occurring in Borneo exists, e. g. of *Plesiophthalmus*, *Eumolpocyriogeton*, *Euspinamarygmus*, and *Spinamarygmus*. According to the currently used definitions, for instance, *Plesiophthalmus keningauensis* Masumoto, 2001, could also be assigned to *Euspinamarygmus* because of the bent protibiae in both sexes, or *Eumolpocyriogeton sasajii* Masumoto, 1988 could be included in *Spinamarygmus* Pic because of the abruptly bent male protibiae. Thus, the following preliminary key to the Bornean genera of the Amarygmini is only suitable for material already known from Borneo, and improvements must be made when genera near to *Plesiophthalmus* have been revised.

1 Profemora without tooth, spine or sharp interruption of the outline, but there may be a bulge-like swelling (Figs. 4A, 13A–58A) **2**

– Profemora anteriorly with a tooth, spine or at least a distinct sharp interruption of the outline, usually situated between middle and apical third of the femora (Figs. 7A–12A), rarely just anterior to the apex (Fig. 6A); step-like interruption in *Pontianacus* only present in the females (Fig. 5C) **7**

2 Antennomere 11 very long (Fig. 1E). Aedeagus with hairs dorsally and ventrally (Fig. 1F–H). [Body length of the only known species 8.60–9.35 mm.] ..... ***Seorsoplonyx* n. gen.**

– Antennomere 11 of average length. Aedeagus without hairs dorsally and ventrally **3**

3 Elytra, pronotum and parts of the legs with spots of dense, short hairs hiding the surface. – Elytra parallel-sided, with fovea-like punctures. [A single species, *J. kumei* Masumoto, 2000 on Borneo, with a body length of 10.2 mm.] .. .. ***Javamarygmus*** Pic

– Elytra, pronotum and legs without spots of hair. **4**

4 Pronotum anteriorly with two bumps separated in the middle by a deep groove, bumps tapering posteriorly. Elytral intervals 3, 5, and 7 with a sharp keel, the other intervals plain (Fig. 2). [*M. costatus* Pic, the only species of this genus, is known from Vietnam, Laos, Java, and Sabah; body length 8.4–10.0 mm.] ..... ***Macrosynopticus*** Pic

– Pronotum without bump-like elevations. Elytra without sharp keel-like elevations on intervals 3, 5, and 7 ..... **5**

5 Antennae filiform, antennomeres 6–11 not separated by a narrow base (Fig. 3E). – Tarsomeres short (Fig. 3A). [Two species known from Borneo] ..... ***Cerysia*** Bremer

– Antennae not filiform, at least antennomeres 6–11 distinctly separated by a narrow base (Figs. 4A–58A) **6**

6 Frons separated from genae by a narrow and deep groove which extends from the fronto-clypeal suture to the inner edge of eyes. Small, oval species. Elytra with convex intervals (Fig. 4C). [*C. preangerensis* (Pic, 1952) is the only described species, body length 4.30–5.24 mm – see Pic 1952; another as yet undescribed species occurs on Sumatra.] .... ***Cephalamarygmus*** Bremer

– Frons and genae not separated by a narrow and deep groove. Body length 2–23 mm. Shape of body and structure of elytra very variable (Figs. 14–58). – For additional characters see chapter 3. [About 150 described and as yet undescribed species on Borneo, but probably the real number is much greater.] ..... ***Amarygmus*** Dalman

7 Male profemora anteriorly with long and dense hairs but without tooth (Fig. 5A), female profemora without long and dense hairs but with a sharp step-like interruption in the apical third (Fig. 5C). – Additional characters: Protibiae of males with long hairs on inner side (Fig. 5B). Femora red except a black apical cap. Upperside opaque. Body elongate (length/width of elytra 1.65–1.76 : 1), elytra not much wider

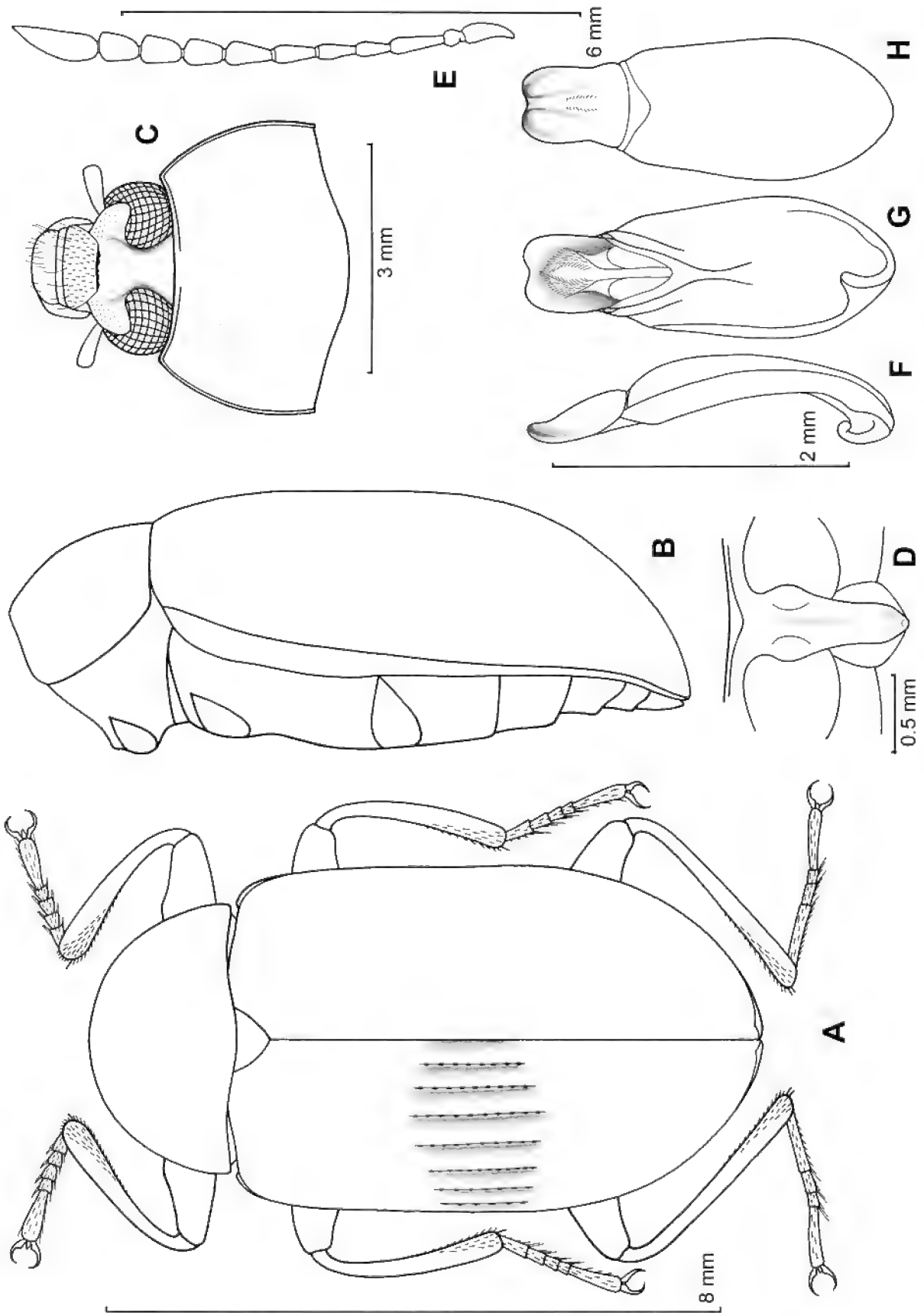


Fig. 1. *Seorsoplonyx antennatus* n. sp. – **A** Habitus. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

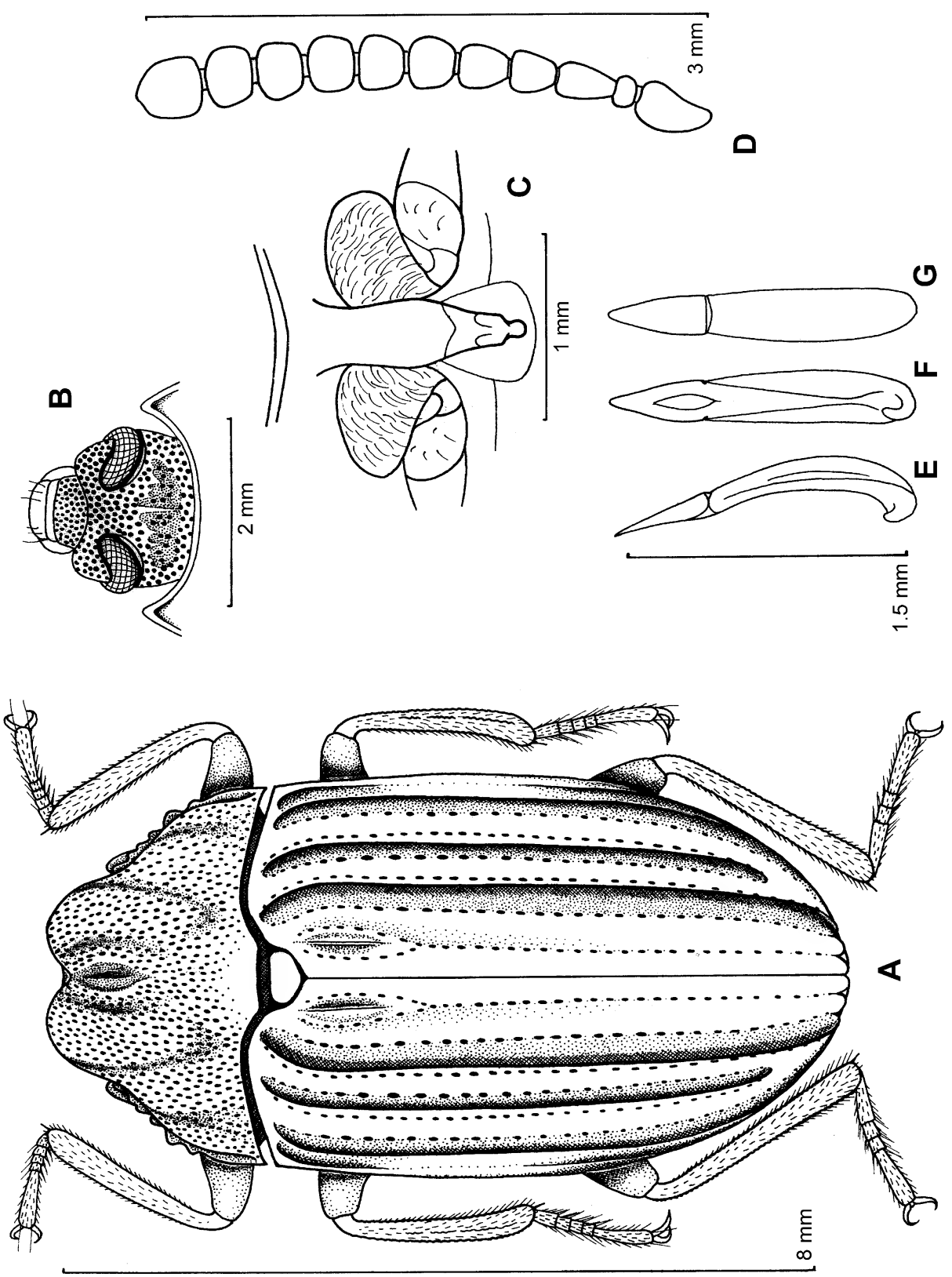


Fig. 2. *Macrosynopticus costatus* Pic, 1922. – **A** Habitus, ♂. **B** Head. **C** Prosternal apophysis. **D** Antenna. **E** Aedeagus, lateral view. **F** Aedeagus, ventral view. **G** Aedeagus, dorsal view.

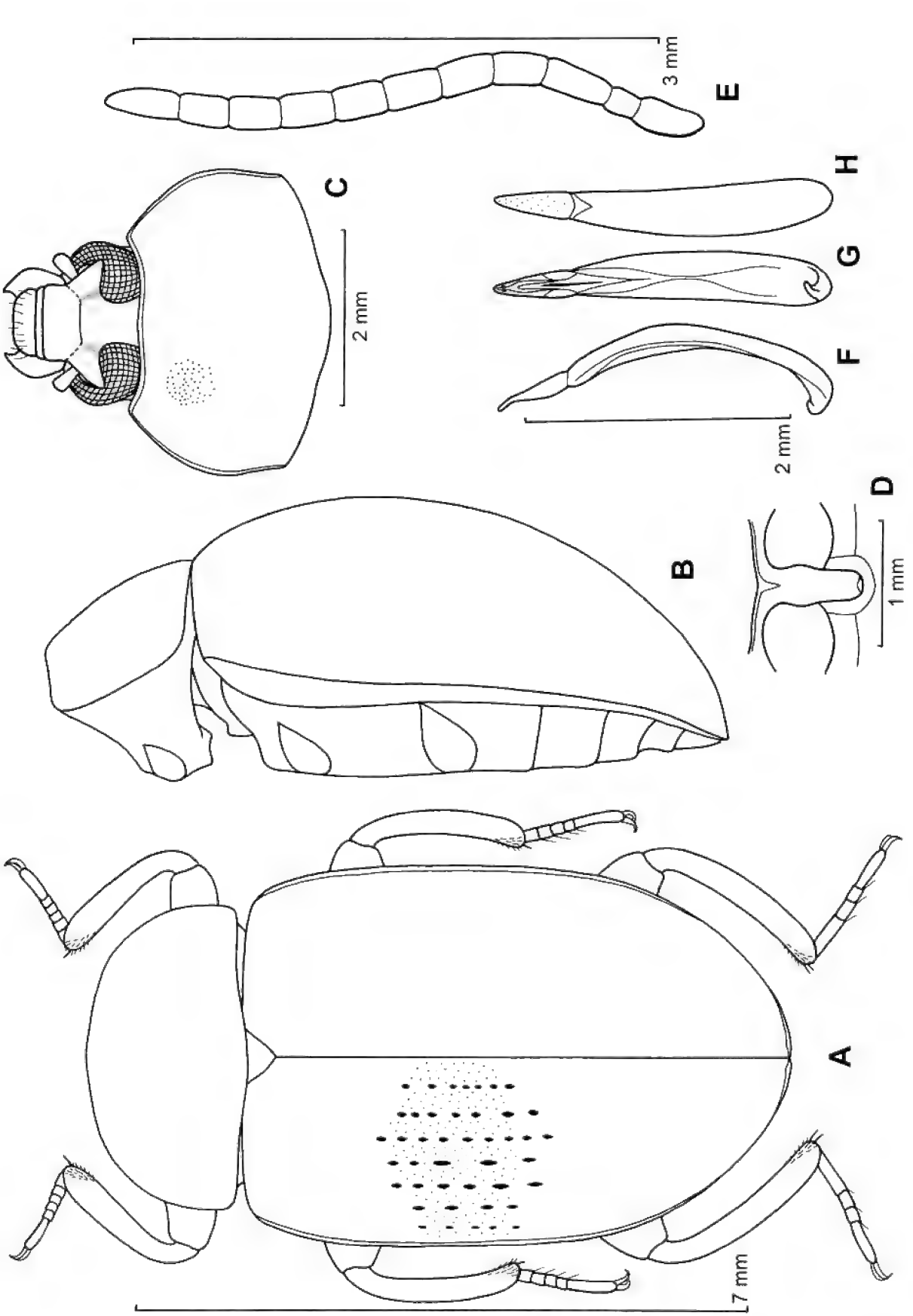


Fig. 3. *Cerysia laevicornis* (Blair, 1929). – **A** Habitus, ♂. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

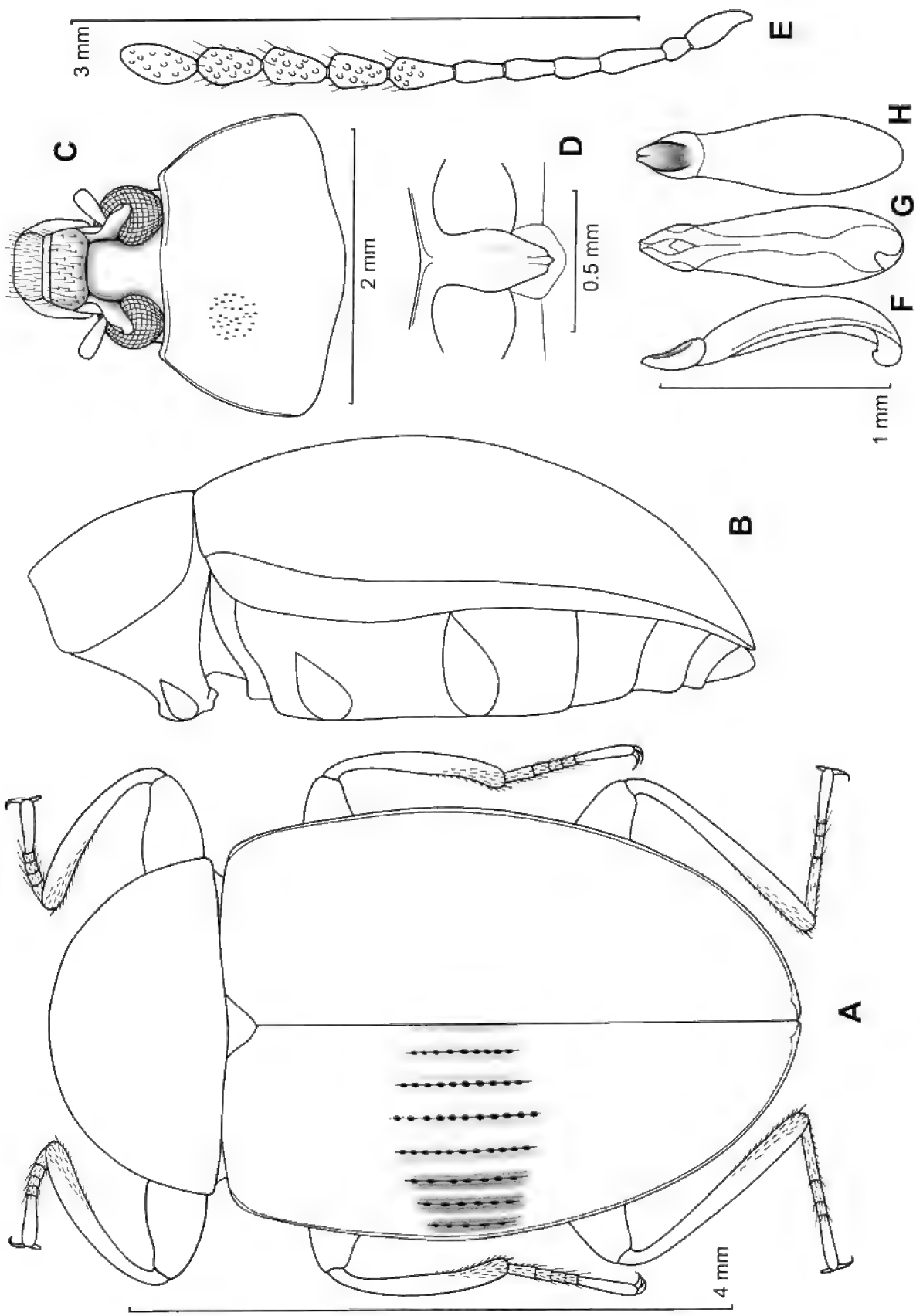


Fig. 4. *Cephalamarygmus preangerensis* (Pic, 1952). – **A** Habitus, ♂. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view (the shaded area shows the depression).

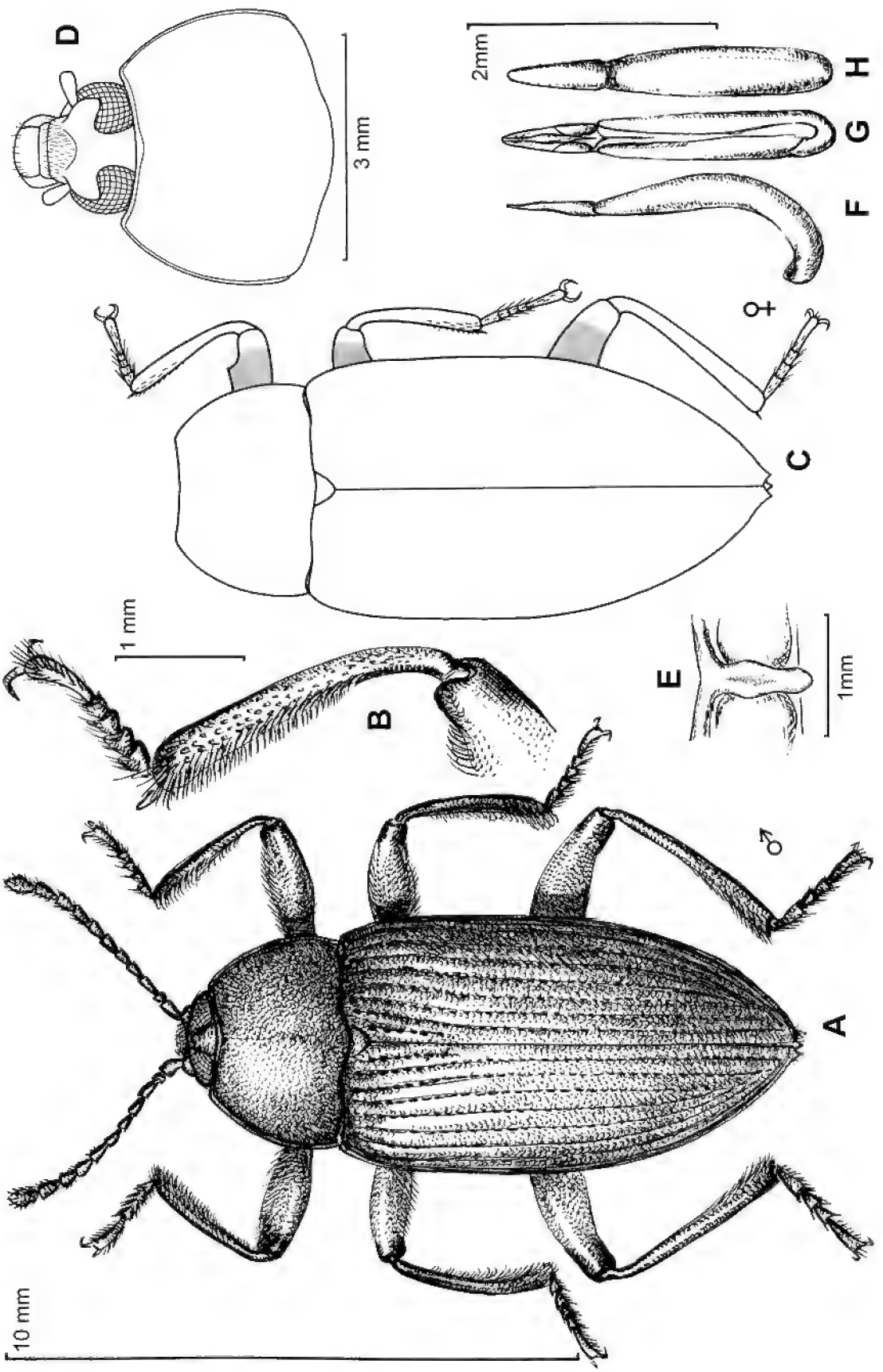


Fig. 5. *Pontianacus rubricrus* Fairmaire, 1898. – **A** Habitus, ♂. **B** Protibia and protarsomeres, ♂. **C** Habitus, ♀. **D** Head and pronotum. **E** Prosternal apophysis. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

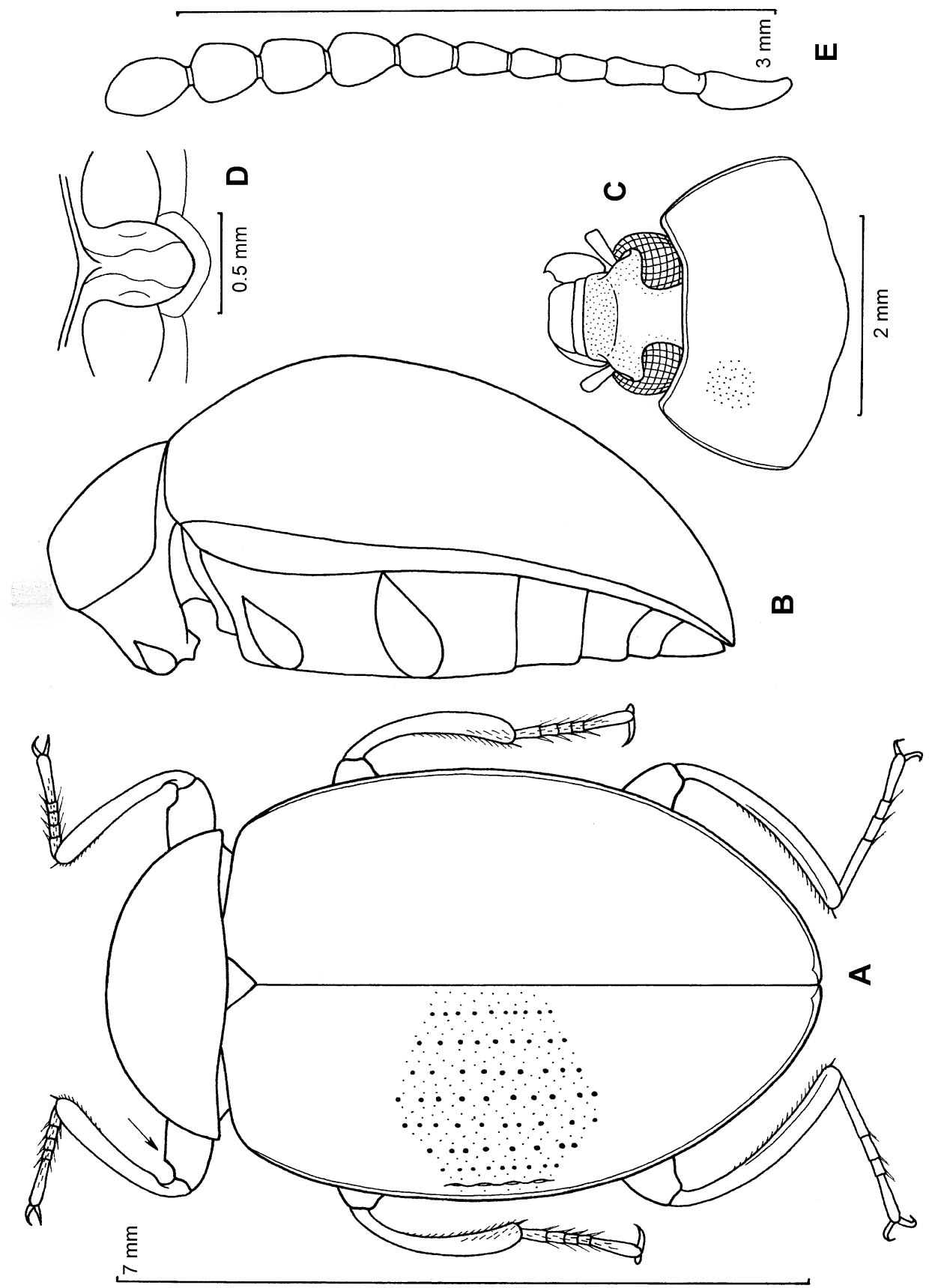
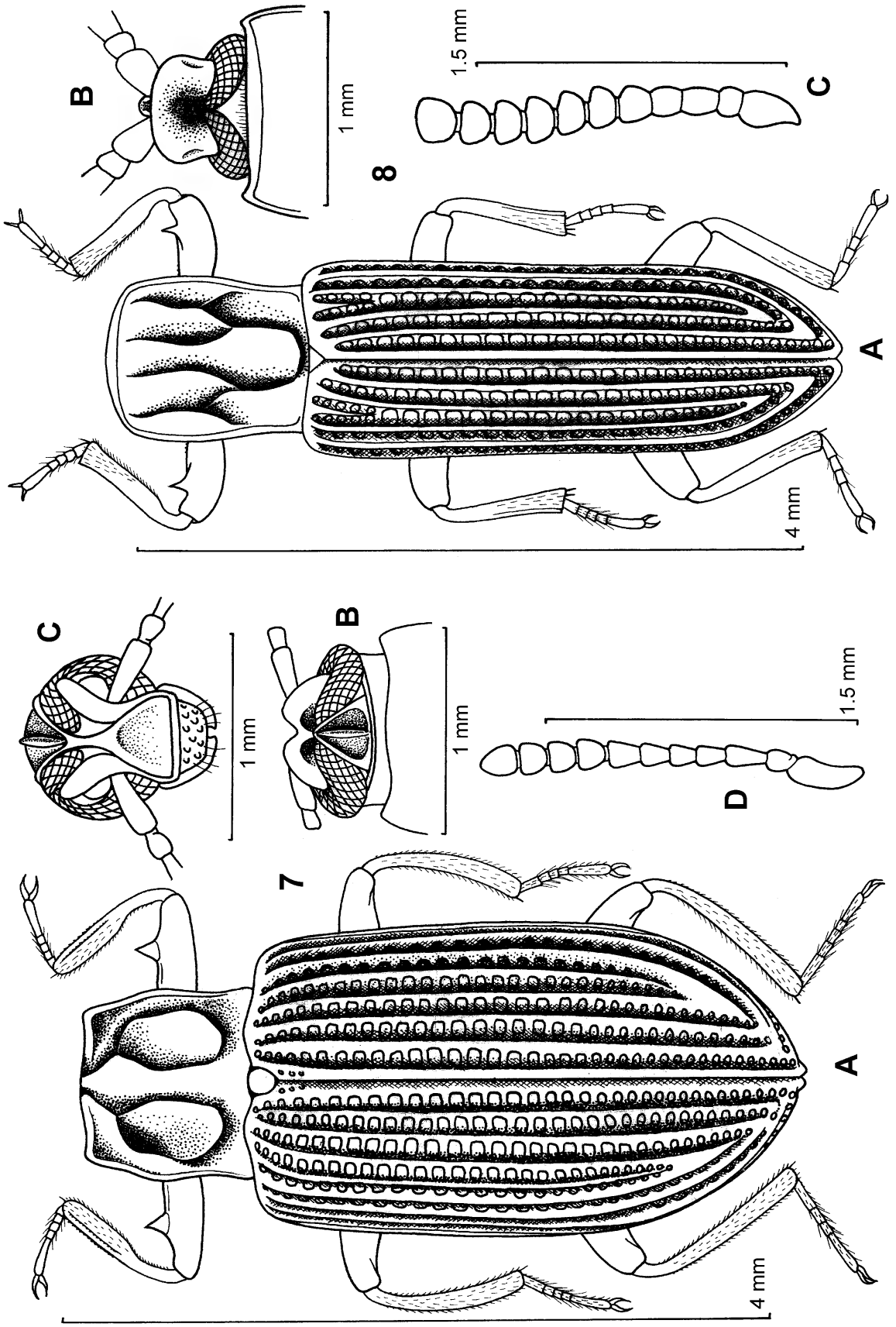


Fig. 6. *Sylvanoplonyx femoralis* n. sp. – **A** Habitus. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna.



Figs. 7–8. Amarygmini. – 7. *Paragonocnemis (Borneogonocnemis) ruficolor* (Pic, 1936): **A** Habitus. **B** Head, dorsal view. **C** Head, frontal view. **D** Antenna. – **8.** *Azarelius sculpticollis* Fairmaire, 1892: **A** Habitus. **B** Head, dorsal view. **C** Antenna.

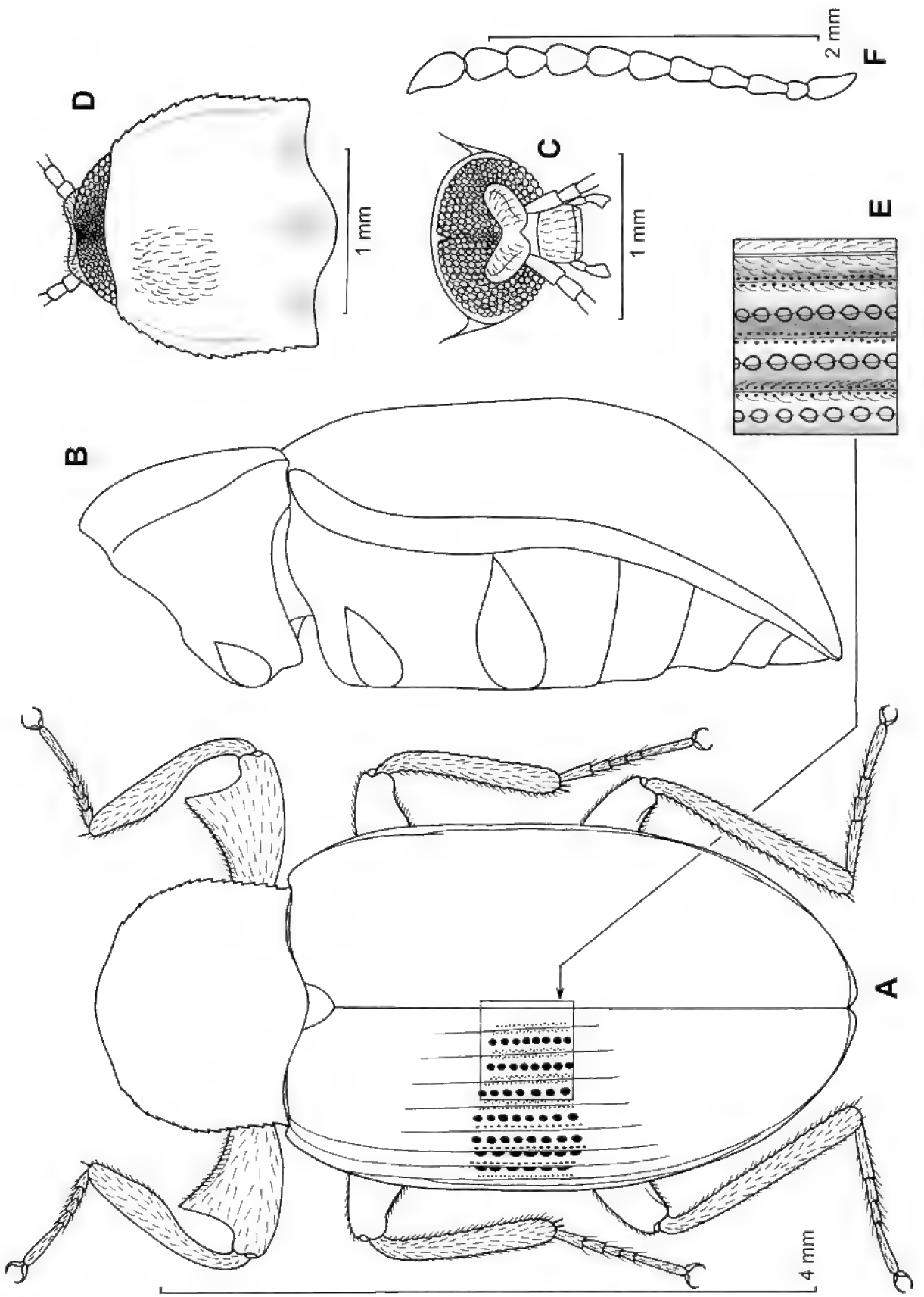


Fig. 9. *Gonocnemis sumatrensis* Pic, 1915. – **A** Habitus. **B** Body, lateral view. **C** Head, frontal view. **D** Pronotum. **E** Detail of elytra. **F** Antenna.

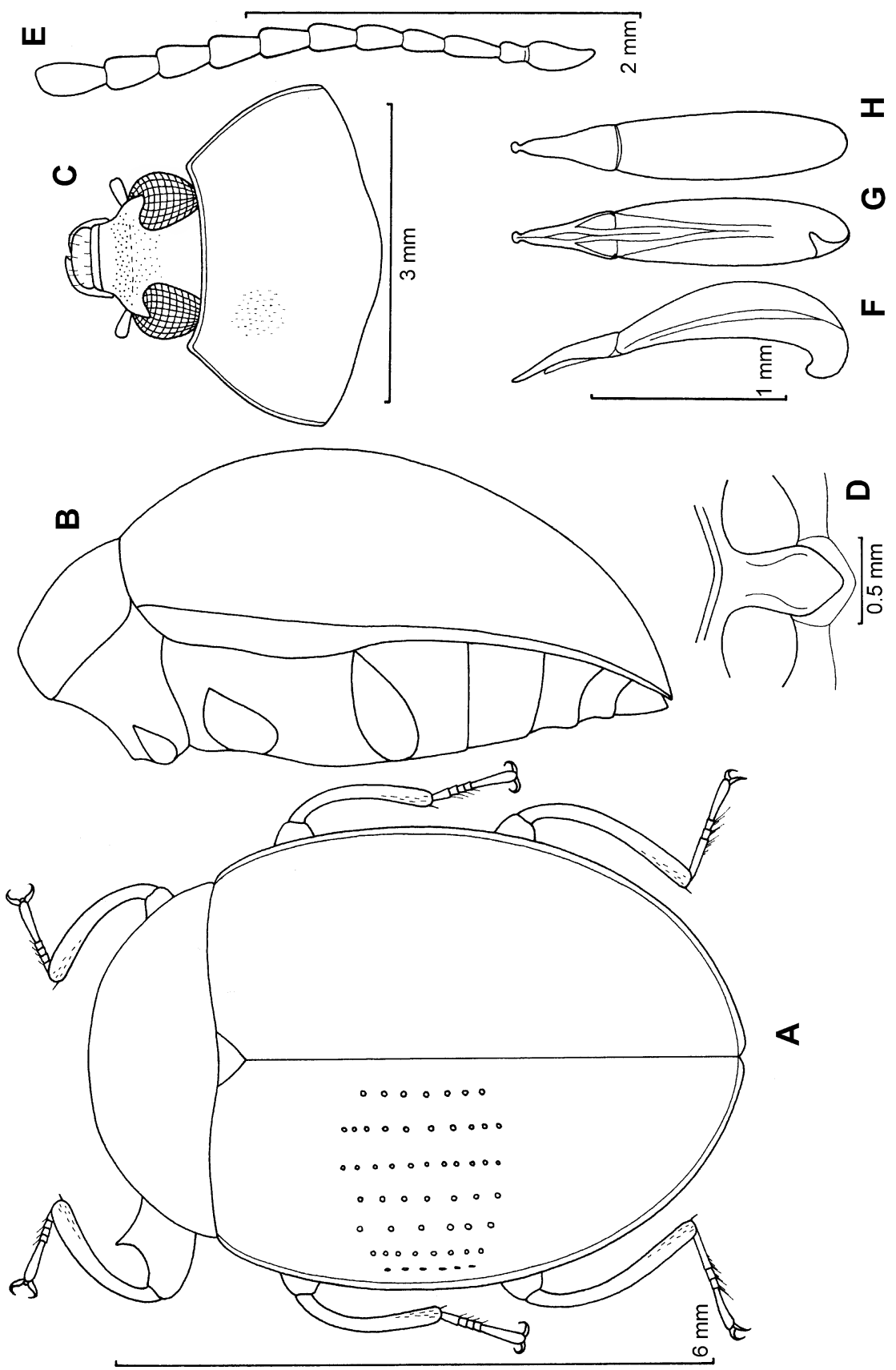


Fig. 10. *Euspinamarygmus kaszabi* Masumoto, 1989. – **A** Habitus, ♂. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

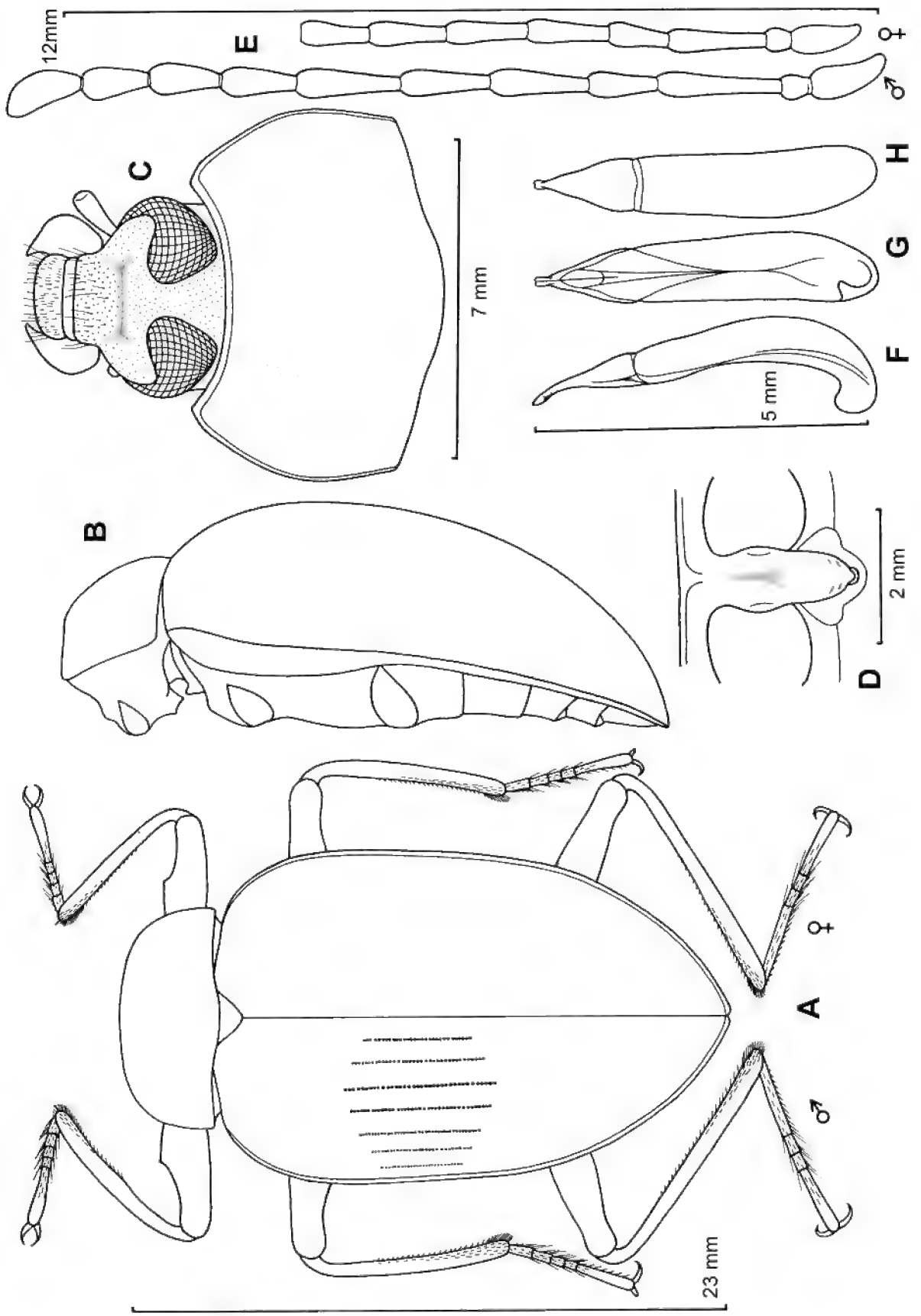


Fig. 11. *Plesiophthalmus andoi* Masumoto, 1989. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antennae ♂ and ♀. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

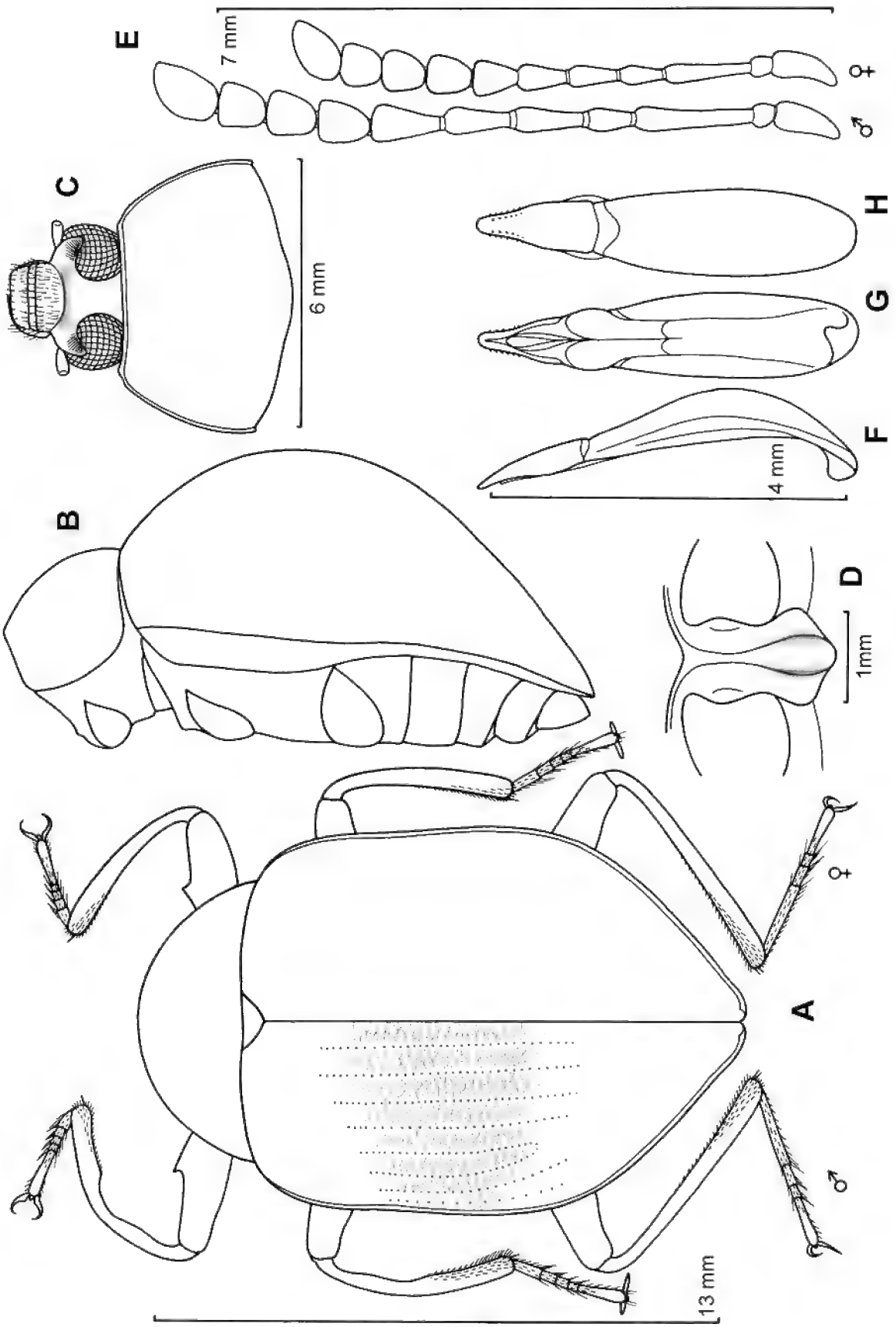


Fig. 12. *Eumolpocyriogeton sasajii* Masumoto, 1988. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antennae ♂ and ♀. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

than pronotum. Body length 11.9–13.9 mm. (Females of this genus may easily be mistaken as species of *Plesiophthalmus*, but *Plesiophthalmus* from Borneo have no opaque upperside). [*P. rubricrus* Fairmaire, 1898 is the only species of this genus; another undescribed species occurs on New Guinea.] ..... ***Pontianacus*** Fairmaire

– Profemora anteriorly with a tooth or step-like decline in both sexes..... **8**

8 Profemora anteriorly with a sharp step-like decline just anterior to the apex (Fig. 6, arrow). – Body length 7 mm. [A single species known.] ..... ***Sylvanoplonyx* n. gen.**

– Profemora anteriorly with a tooth or step-like decline between middle and apical third..... **9**

9 Pronotum with sharp, more or less bent keels on the upperside (Figs. 7–8.). Body length < 4 mm. – Profemora with an acutely projecting tooth..... **10**

– Pronotum without sharp keels. Body length variable. **11**

10 The genae are situated somewhat in front of eyes but they are not forming a bump (Fig. 7B–C). Pronotum wider than long (Fig. 7A). Intervals 1–3 keeled reaching nearly to apex of elytra. Upperside of elytra opaque. [Two species known from Borneo.] ..... ***Paragonocnemis*** subgen. ***Borneogonocnemis*** Pic

– The genae are well separated from eyes and frons, and they form a distinct bump (Fig. 8B). Pronotum longer than wide (Fig. 8A). Keel-like elytral intervals not reaching to apex. Elytra very long and narrow, upperside lustrous. [*A. bryanti* Blair, 1914 is the only species known from Borneo, but also *A. sculpticollis* Fairmaire, 1892 may occur.] ..... ***Azarelius*** Fairmaire

11 Tibiae plain on outer side (Fig. 9A), bordered by an edge with tiny teeth like a saw-blade. Upperside of body with hairs (in one tiny species these hairs are very short and only visible at about 25-fold magnification). – Profemora with a large, acutely projecting tooth. [Five species known from Borneo.] ..... ***Gonocnemis*** Thomson

– Tibiae rounded in cross-section on outer side. Upperside of body without hairs in species from Borneo..... **12**

12 Profemora anteriorly with a distinct tooth. Protibiae regularly bent in both sexes. Without a rim between eyes and frons. – Base of pronotum as wide as base of elytra (Fig. 10). Body oval in species from Borneo. Body length 5.5–8.1 mm. [A single species, *E. kaszabi* Masumoto, 1989, known from Borneo (a second species will be described in a forthcoming paper).] ..... ***Euspinamarygmus*** Masumoto

– Profemora with a sharp, step-like interruption of the outline. Protibiae differently bent in males and females (in species from Borneo). Elytra usually longer than in the preceding genus, if not longer then a distinct rim between eyes and frons..... **13**

13 Elytra more or less oblong (Fig. 11A, B). Base of elytra markedly wider than base of pronotum. Body length 6.7–30 mm. – A rim around eyes is found in some small species. [12 species known from Borneo.] ..... ***Plesiophthalmus*** Motschulsky

– Elytra longitudinally more convex and shorter than in the species of the preceding genus (Fig. 12A, B). No rim around the eyes. Body length 13–15 mm. [I doubt whether the two described Bornean species are correctly placed in this genus. They might better be assigned to *Spinamarygmus* or, even better, to *Plesiophthalmus* (after a more comprehensive definition of the specific characters). For a more detailed discussion of this matter see the forthcoming last part in this series on the Amarygmini of Borneo.] ..... ***Eumolpocyriogeton*** Pic

5 Descriptions of new genera and species of Amargmini

Seorsoplonyx antennatus n. gen., n. sp.

Type species: *Seorsoplonyx antennatus* n. sp.

Etymology

Seorsus (Lat.) = secluded; plonyx = suffix of many genera of Amarygmini.

Diagnosis of the genus

Of medium size. Oblong, with long, subparallel elytra. Elytra scarcely convex longitudinally, with narrowly incised striae; intervals convex. Antennae long, with a very long and somewhat bent antennomere 11 as in the African genus *Praeugena* Laporte, 1840 (Praeugenini De Moore, 1970). Profemora in the anterior basal half with a sharp edge which terminates in a club-like bulge in the middle of the femora. Parameres of aedeagus with tiny hairs on their apical part ventrally and dorsally.

The new genus *Seorsoplonyx* is characterized by the peculiar shape of the antennae and the hairs on the aedeagus, a combination of characters which is otherwise unknown in Amarygmini.

Seorsoplonyx antennatus n. sp. (Fig. 1A–H)

Holotype (♂): Keningau, Sabah, N Borneo, 30.V.1989, M. Itoh (NSMT).

Paratypes: Keningau, Sabah, N Borneo, 25.V.1989, M. Itoh (1 ♂ ZSMB). – Same data as before, but 11.VI.1989 (1 ♀ CA). – Kimanis Road nr. Keningau, Sabah, Borneo, 5.V.1994 (1 ♀ CM). – Mt. Trus Madi, 1300 m, Sabah, Borneo, 9.–10.IV.1994, N. Kanie leg. (1 ♂ CA). – Sujah near Sanggau Ledo, Kalimantan Barat, 26.–27.VII.1986, N. Nishikawa leg. (1 ♀ CM).

Etymology

Antennatus (Lat.) = adjective of antenna.

Diagnosis

See diagnosis of the genus.

Description

Measurements: Body length 8.60–9.36 mm; body width 4.50–4.78 mm. – Ratios: Pronotum: width/length 1.59–1.63; width hind corners/width front corners 1.59–1.68. Elytra: length/width 1.46–1.55; length elytra/length pronotum 3.00–3.20; maximum width elytra/maximum width pronotum 1.27–1.29.

Colouration: Upperside dark brown, pronotum and elytra with a faint sericeous shine. Underside blackish brown, slightly lustrous. Legs blackish brown. Antennomeres 1–6 brown, 7–11 black.

Head: Frons of medium width, slightly narrower than length of antennomere 3 (like 15 : 17); frons slightly convex transversely and longitudinally; with a clear and almost furrow-like depression between frons and genae. Genae markedly raised, anteriorly terminating clearly anterior to the middle part of the fronto-clypeal suture. Fronto-clypeal suture almost groove-like incised in its middle part. Clypeus slightly convex, with very small, closely set punctures. Punctures of frons sparser than those of clypeus. Mentum reversely trapezoidal, with wide, flat margins, space in between transversely convex. Outer surface of mandibles with a longitudinal sulcus, apically bifid.

Pronotum: Markedly convex transversely and longitudinally. Lateral margins rounded with a tendency to be narrowed towards hind corners. Anterior margin slightly excavated. Lateral margins bordered, border of anterior margin weakened in its middle. Lateral borders in dorsal view visible over its whole length, but very narrow in the anterior half. Front corners in lateral view rounded, slightly obtuse; hind corners angular, similarly obtuse as front corners. Surface with tiny, sparse punctures.

Scutellum: Triangular, with rounded sides and few tiny punctures.

Elytra: Oblong, not very wide, markedly convex transversely, not convex longitudinally and descending only in the apical part. Lateral margins straight. Shoulders somewhat prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view narrowly visible, starting just behind shoulders and terminating at the level of the posterior third. With clearly incised striae, punctures within striae small; distance between punctures in stria 4 about 1–2 diameter of a puncture. Intervals convex, with tiny, widely separated punctures.

Prosternum: Anterior margin continuously and narrowly bent upwards, not retracted towards apophysis in its middle. Apophysis narrow, oblong, stretched backwards behind coxae, but behind coxae situated slightly below the level of the more anterior parts; along coxae slightly widened and margins raised, space in between like a shallow trough; whole surface showing a rough structure.

Mesosternum: With a shallow, longitudinal sulcus laterally; anterior margin deeply excavated in the middle.

Metasternum: Anterior margin between mesocoxae widely rounded, broadly bordered. Disc with microreticulation and some tiny hairs. Median line slightly incised, along this incision with some small, shallow punctures.

Sternites: More strongly microreticulated than metasternum. Anterior margin of sternite 1 between metacoxae ogival, faintly bordered. Discs with sparse, tiny, dust-like hairs. Sternites with a slight depression on the discs in males.

Antennae: Of medium length, reaching slightly anterior to middle of elytra. Antennomere 11 very long, slightly sickle-shaped. Length/width ratio of antennomeres 1–11 equals to 14:6 / 5:5 / 17:5½ / 10:5½ / 13:5½ / 13:5½ / 15:8 / 13:8½ / 12:9 / 12:9 / 25:9.

Legs: Of medium length. Profemora thickened towards the second third, anterior basal half with a sharp edge which terminates in the club-like bulge. Meso- and metafemora also with a club-like thickening, but without a sharp edge in their basal half. Pro- and mesotibiae somewhat widened anteriorly, slightly bent. Metatibiae almost straight; males with a very small area of dense recumbent hairs apically on inner side of pro- and mesotibiae. Protarsomeres 1–3 not widened in males. Lengths of protarsomeres 1–5 as 3:3:3:3:17, lengths of mesotarsomeres 1–5 as 7:5:4:4:18, lengths of metatarsomeres 1–4 as 15:7:5:17.

Aedeagus: See Fig. 1F–H.

Sylvanoplonyx femoralis **n. gen., n. sp.**

Type species: *Sylvanoplonyx femoralis* n. sp.

Etymology

Sylvanus, a god of forests; plonyx = frequently used suffix for naming genera of Amarygmini.

Diagnosis

A genus with the shape of *Amarygmus*, but profemora anteriorly with a sharp edge which declines like a step just anterior to the apex (Fig. 6A, arrow).

A similar steplike decline is known as character of *Plesiophthalmus*, but in this genus the decline is situated in the middle or at most at two-thirds of the profemora.

Sylvanoplonyx femoralis **n. sp.**
(Fig. 6A–E)

Holotype (♀): Keningau, Sabah, N Borneo, 11.VI.1989, M. Itoh (CA).

Etymology

Femoralis, adjective of femur.

Diagnosis

See diagnosis of the genus.

Description

Measurements: Body length 7.09 mm; body width 4.22 mm. – Ratios: Pronotum: width/length 2.05; width hind corners/width front corners 1.69. Elytra: length/width 1.28; length elytra/length pronotum 3.68; maximum width elytra/maximum width pronotum 1.39.

Colouration: Pronotum and frons dark green. Clypeus brown. Elytra bronze, somewhat lustrous, with faintly coloured, longitudinal stripes. Legs brownish black, tarsi brown. Antennomeres 1–5 brownish black, antennomeres 6–11 black. Underside black, lustrous.

Head: Upperside microreticulated. Frons of medium width, as wide as combined length of antennomeres 2+3. Genae raised, anteriorly terminating in front of the middle part of the fronto-clypeal suture. Fronto-clypeal suture negligibly incised in its middle part. Clypeus moderately stretched forwards, slightly convex longitudinally. Clypeus and frons with small punctures which are closer set on clypeus than on frons. Mentum relatively wide; lateral margins flat, widened anteriorly, somewhat bent, space in between transversely convex and lustrous. Underside of neck with small, closely set punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Wide, uniformly convex transversely, less convex longitudinally. Widest at base, anteriorly narrowing and bent. Anterior margin moderately excavated. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view narrowly visible. Front and hind corners in lateral view obtuse, front corners more rounded than hind corners. Surface with small, irregularly set punctures.

Scutellum: Triangular, with a few tiny punctures.

Elytra: Oval, moderately convex transversely and longitudinally. Maximum height and width slightly anterior to the middle. Shoulders slightly prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view narrowly visible. With rows of medium-sized punctures which become indistinct near apex; distance between punctures on disc in row 4 about 2 times diameter of a puncture; about 25 punctures in row 4. Intervals flat, with tiny, widely separated punctures (visible at 50-fold magnification).

Prosternum: Anterior margin narrowly bent upwards, retracted towards apophysis in its middle. Apophysis oval; margins raised along procoxae, space in between with a wide sulcus which is widened posteriorly.

Mesosternum: Anterior margin excavated in its middle; lateral margins rounded, irregularly covered with coarse punctures; median part smooth.

Metasternum: Anterior margin between mesocoxae widely rounded, bordered. Apophysis behind anterior margin slightly raised. Anterior part of disc with large, irregularly set punctures, posterior part without punctures.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, very narrowly bordered. Sternites without punctures.

Antennae: Antennae reaching to anterior fourth of elytra. Length/width ratio of antennomeres 1–11 equals to 20:9 / 9:7½ / 14:7 / 11:7 / 12:8 / 13:9 / 14:11 / 18:14 / 18:15 / 17:15 / 22:15.

Legs: Short. For femora see diagnosis of the genus. Protibiae straight, meso- and metatibiae moderately convex. Lengths of protarsomeres 1–5 as 7:5:5:5:23, lengths of mesotarsomeres 1–5 as 10:8:7:7:24, lengths of metatarsomeres 1–4 as 26:11:9:25.

6 Descriptions of new species of *Amarygmus*

Amarygmus abortivus n. sp.
(Fig. 13A–H)

Holotype (♂): Borneo, Sabah, Danum Valley NP, 25.VI.2006, Ulf Bremer leg. (ZSMB).

Paratypes: Borneo, Sabah, Danum Valley, 4°58'N 117°48'E, M. D. F. Ellwood, *Parashorea tomentella*, *Asplenium nitidus*, East Trail 7, FogTray 5, 11.VII.1999, "399" (1 ♂ BMNH). Same data as before, but Tembaling 2, FogTray2. 19.X.1999 (1 ♀ BMNH)

Circumstances of collection (of the holotype): Edge of lowland primary forest, on the bark of a tree, at night.

Etymology

Abortivus (Lat.) = premature.

Diagnosis

Very small, oval, lustrous. Elytra with striae and nearly plain intervals on disc. Frons wide. Antennae of medium length, in males longer than in females. Protibiae in males widened in the apical two-thirds of inner side. Metatarsomere 1 nearly as long as combined length of metatarsomeres 2–4.

A. snizeki Bremer, 2002 (Bremer 2002a: 39), also from Sabah, has the same size (body length 3.35–3.81 mm), a wide frons, striae on the elytra and the same sexual characters of the male protibiae. However, metatarsomere 1 of *A. snizeki* is markedly shorter than in *A. abortivus*. Other similar species of this group, e. g. *A. crenis* Bremer, 2009 from the Malayan Peninsula (body length 3.27–3.42 mm), have a narrower frons.

Description

Measurements: Body length 3.22–3.42 mm; body width 1.87–2.02 mm. – Ratios: Pronotum: width/length 1.86–1.95; width hind corners/width front corners 1.67–1.78. Elytra: length/width 1.37–1.42; length elytra/length pronotum 3.30–3.38; maximum width elytra/maximum width pronotum 1.25–1.33.

Colouration: Head black, opaque. Pronotum copper-coloured, opaque. Elytra dark copper-coloured, lustrous, light brown along elytral suture. Underside brown, lustrous. Femora brown, tibiae darker brown than femora. Antennomeres 1–4 brown, 5 dark brown, 6–11 black (antennomere 11 apically brightened).

Head: Frons and clypeus flat. Frons wide, somewhat narrower than combined length of antennomeres 2+3,

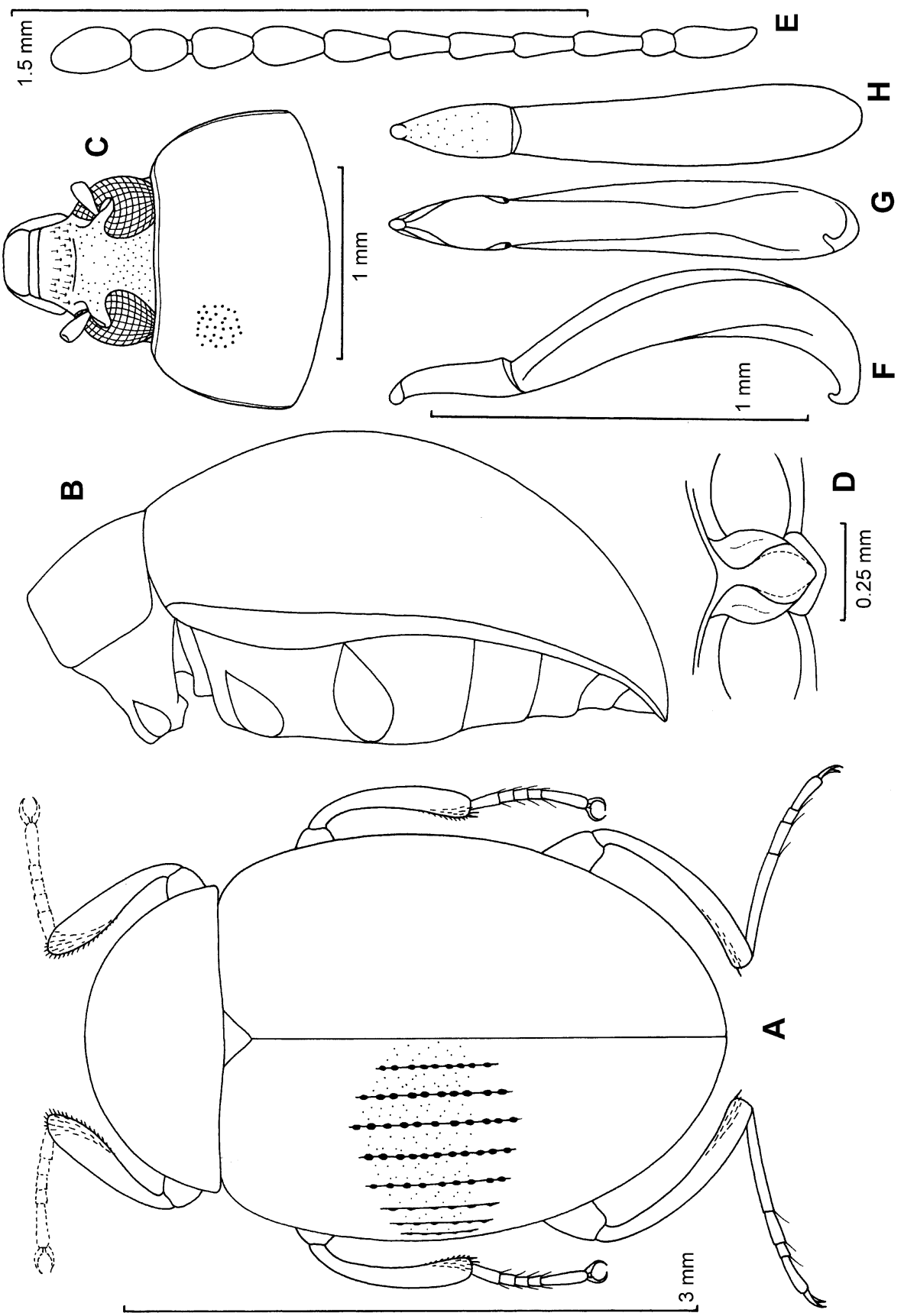


Fig. 13. *Amarygmus abortivus* n. sp. – **A** Habitus, ♂. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

with indistinct, small punctures in the posterior part of the frons, nearly impunctate in the anterior part. Genae scarcely raised, anteriorly terminating anterior to the level of the middle part of the fronto-clypeal suture. Fronto-clypeal suture weakly incised in its middle part. Clypeus stretched forwards, scarcely convex, with tiny, sparse punctures and very short hairs originating from these punctures. Mentum large, enlarged apically, with distinct flat margins laterally; median space in between more opaque and slightly convex, with a median, nitid clasp. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Relatively large, markedly convex transversely, weakly convex longitudinally. Sides subparallel in the posterior three-fifths, convergent and bent anteriorly. Front corners in dorsal view not visible. Anterior margin straight. Lateral and anterior margins bordered. Lateral borders in dorsal view visible only in the posterior two-thirds. Front corners in lateral view rounded; hind corners markedly obtuse, angular. Surface with small, irregularly set punctures.

Scutellum: Triangular, with a few tiny punctures.

Elytra: Oval, markedly convex transversely, less convex longitudinally. Maximum height and width slightly anterior to the middle. Shoulders slightly prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view visible only in and posterior to the middle. With slightly incised striae; in stria 4 with medium-sized, somewhat irregularly set punctures, about 35 punctures in stria 4. Intervals on disc very slightly convex, with tiny, widely separated punctures.

Prosternum: Anterior margin narrowly bent upwards laterally, a narrow keel originating from the middle of the anterior margin, extending across the whole apophysis and widened apically. Apophysis rounded laterally along procoxae and raised ventrad, space in between with a marked groove, apically broadly pointed.

Mesosternum: Anterior margin excavated in the middle; posterior part laterally with a slight longitudinal sulcus.

Metasternum: Anterior margin between mesocoxae rounded, broadly bordered. Disc behind anterior margin with some small punctures, otherwise impunctate. Median line narrowly incised.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, bordered. Sternites impunctate. Sternite 5 apicomedially not depressed in male.

Antennae: Of medium length, reaching to middle of elytra. Length/width ratio of antennomeres 1–11 in male equals to 8:4 / 6:3½ / 9:3½ / 6:4½ / 7:4½ / 7½:5 / 8:5½ / 8:5½ / 8:5½ / 8:5½ / 10:6.

Legs: Short. Femora thickened towards the second third. Protibiae in male nearly straight on outer side, widened beyond basal fifth on inner side. Mesotibiae apically slightly widened, bent. Metatibiae apically slightly widened, slightly more bent than mesotibiae. Protarsomeres 1–3 not widened in male. Lengths of protarsomeres 1–5 as 3:3:3:3:11, lengths of mesotarsomeres 1–5 as 7:4:4:3½:11, lengths of metatarsomeres 1–4 as 23:8:4:11.

Aedeagus: See Fig. 13F–H.

Amarygmus adornatus **n. sp.**
(Fig. 14A–H)

Holotype (♂): Borneo, Malaysia, Sabah, Kinabalu NP, Poring vic., 380 m, 9.–11.III.2007, R. Grimm (CG).

Paratypes: Same data as holotype (2 ♂♂ CG, 1 ♂ ZSMB, 2 ♀♀ CG, 1 ♀ ZSMB). – Borneo, Malaysia, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 10–200 m, 4.–8.IV.2009, R. Grimm (1 ♀ CG). – Borneo, Malaysia, Sarawak, Gunung Gading NP, 100–300 m, 31.III.–4.IV.2009, R. Grimm (1 ♀ ZSMB). – Borneo, Malaysia, Sarawak, Kubah NP, HQ vic., 100–300 m, 27.–28.III.2009, R. Grimm (1 ♀ CG).

Circumstances of collection: Primary forest, on rotten wood decayed by fungi, at night.

Etymology

Adornatus (Lat.) = decorated.

Diagnosis

Large, oblong, oval. On each elytron with two large, reddish brown maculae; pronotum reddish brown in its anterior half, black in its posterior half; frons and clypeus black. Forelegs markedly longer in males than in females; male protarsomeres 1–3 widened and prolonged, protarsomeres 1–4 with erect hairs laterally; back of metafemora and inner side of metatibiae without long hairs in males.

Concerning body shape and form of maculae, *A. adornatus* resembles *A. binotatus* Pic, 1915 (redescription and illustration see Bremer 2005c: 10–12, fig. 15). However, the clypeus of *A. binotatus* is somewhat shorter than that of *A. adornatus*, the frons is slightly wider, frons and clypeus are yellowish brown or brown (black in *A. adornatus*), the males have long hairs on back of metafemora and inner side of metatibia (such hairs absent in *A. adornatus*), and the transverse, black band on the elytra extends anteriorly (not extending anteriorly in *A. adornatus*).

A. adornatus is, to some extent, also similar to *A. sanguinans* Fairmaire, 1893 (redescription and illustration see Bremer 2005c: 25–27, fig. 24) because both species have no hairs on back of metafemora and on inner side of metatibiae. However, *A. sanguinans* has the shaft of the femora red (uniformly black in *A. adornatus* and *A. binotatus*), and males of *A. sanguinans* are provided with long hairs apically on the inner side of the protibiae (missing in *A. adornatus* and *A. binotatus*).

Description

Measurements: Body length 7.32–8.44 mm; body width 4.14–4.46 mm. – Ratios: Pronotum: width/length 1.67–1.71; width hind corners/width front corners

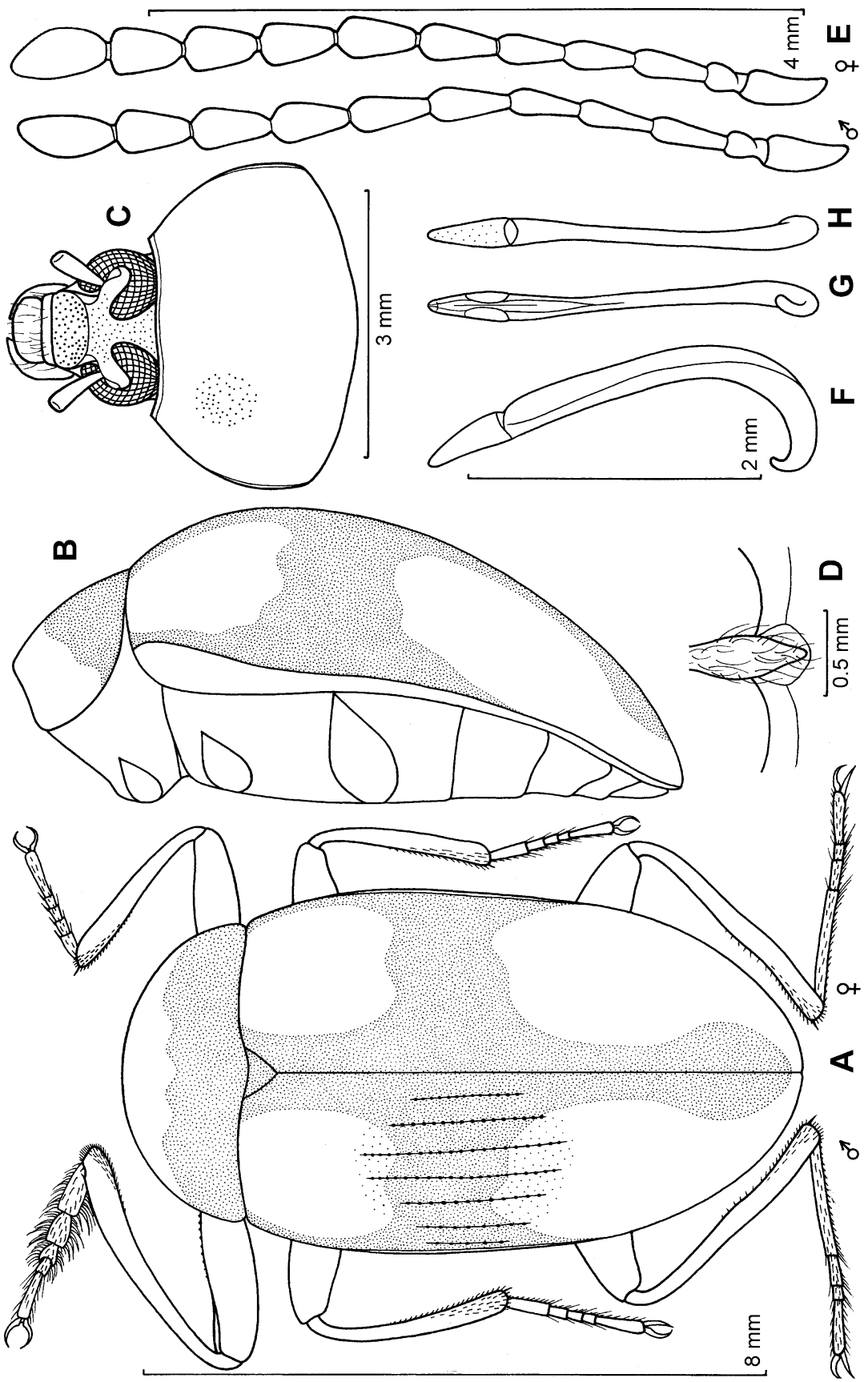


Fig. 14. *Amarygmus adornatus* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antennae ♂ and ♀. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

1.78–1.86. Elytra: length/width 1.44–1.54; length elytra/length pronotum 3.13–3.31; maximum width elytra/maximum width pronotum 1.23–1.29.

Colouration: Head black, lustrous (clypeus with a faint brown tinge). Pronotum greasily lustrous, front part reddish brown, hind part black (with an irregular border between both colours). Elytra with reddish brown maculae on a black ground as outlined in Fig. 14A. Femora and tibiae uniformly black, tarsomeres dark brown. Antennae black. Underside reddish brown (sternites 2+3 darker brown). Hairs yellow.

Head: Frons relatively narrow, of the same width in both sexes, as wide as length of antennomere 2 (like 7 : 6), with small, closely set punctures. Genae short, slightly raised. Fronto-clypeal suture moderately depressed and clypeus situated somewhat lower than frons. Clypeus somewhat stretched forwards, slightly convex longitudinally, with small, closely set punctures. Mentum scarcely convex transversely, its middle part more opaque than the lateral parts, basal and lateral margins bent upwards, sides not widened anteriorly. Underside of neck markedly microreticulated. Mandibles on their outer surface with a sulcus, apically bifid.

Pronotum: Slightly convex transversely and longitudinally. Lateral margins subparallel in their posterior half, slighty bent and convergent in their anterior half. Front corners scarcely protruded. Anterior margin slightly excavated. Lateral borders in dorsal view well visible on its whole length or its posterior two-thirds. Front corners in lateral view rectangular, hind corners obtuse. Surface with minute, closely set punctures.

Scutellum: Triangular, with slightly bent lateral margins, impunctate.

Elytra: Moderately convex transversely and longitudinally. Maximum height at the level of the anterior third. Shoulders not prominent. Lateral edges in dorsal view visible only in the middle part of the elytra. Apices of elytra mutually rounded. With some very short hairs (visible at 25-fold magnification) which are projecting on the apical part of the elytra. With striae with small punctures; distance between punctures less than the diameter of a puncture; striae extending towards apices. Intervals flat on disc, slightly convex laterally, with relatively small, closely set punctures.

Prosternum: Very short. Anterior margin narrowly bent upwards. Apophysis very narrow and spindle-shaped, lateral margins along procoxae slightly widened and very little raised; behind coxae somewhat descending; surface with long, erect hairs in males.

Mesosternum: Anterior margin narrowly and deeply excavated in the middle; lateral margins strongly raised; with long erect hairs in males.

Metasternum: Anterior part of disc with medium-sized, closely set punctures; punctures on posterior part smaller, but also closely set. Disc with long semi-erect hairs in males. Median line incised and depressed on its whole length.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, bordered. Discs of sternites 1 and 2 with medium-sized punctures; sternites 3–5 with punctures which become smaller posteriorly. Discs of all sternites with long erect hairs in males. Sternite 5 apicomedially without depression in males.

Antennae: In males somewhat longer than in females. Length/width ratio of antennomeres 1–11 in male equals to 12:5½ / 6:4½ / 11:4½ / 11:4½ / 13:5½ / 12:5½ / 13:6 / 12:6½ / 12:7 / 12:7 / 15:7½, in female to 13:5½ / 5:4 / 9:4 / 10:4½ / 10:4½ / 11:5 / 11:6½ / 12:6½ / 12:7 / 11:7 / 14:7.

Legs: Profemora and protibiae markedly longer in males than in females. Pro- and mesofemora with a slender base and slightly club-like in their middle, metafemora markedly thickened in the middle. Protibiae in males widened apically, incurved in the apical half, with sharp edges on inner side; in females nearly straight and apically slightly widened. Mesotibiae straight in both sexes, apically with a slight widening. Metatibiae somewhat longer in males than in females and apically more widened and bent, in males in the basal half only with sparse and short hairs. Lengths of protarsomeres 1–5 in male as 17:10:9:7:31, lengths of mesotarsomeres 1–5 as 20:11:8:6:29, lengths of metatarsomeres 1–4 as 55:17:9:31; in female the corresponding lengths are 10:9:8:7:30, 28:9:8:5:30, and 55:17:9:30.

Aedeagus: See Fig. 14F–H.

Amarygmus aeris **n. sp.**
(Fig. 15A–H)

Holotype (♂): Borneo, Sabah, Crocker Range, Gunung Emas, 1500 m, 16.–21.III.2007, R. Grimm (CG).

Paratypes: Same data as holotype (1 ♀ CG, 1 ♀ ZSMB).

Circumstances of collection: Mountainous primary forest, on the bark of a dead, mossy tree, at night.

Etymology

Aeris, genetive of aes (Lat.) = bronze, copper.

Diagnosis

Of medium size. Upperside ruby-coloured, lustrous. Elytra strongly convex longitudinally and transversely, with striae with closely set medium-sized punctures. Pronotum narrower than elytra, clearly descending in respect to elytra. Frons of medium width. Antennae of medium length. Protarsomeres 1–3 not widened in male. Male meso- and metatibiae indistinctly curved and widened on inner side, not widened in female.

The structure of the elytra differs somewhat between male holotype and female paratypes (see "Elytra"). This is regarded as infraspecific variability.

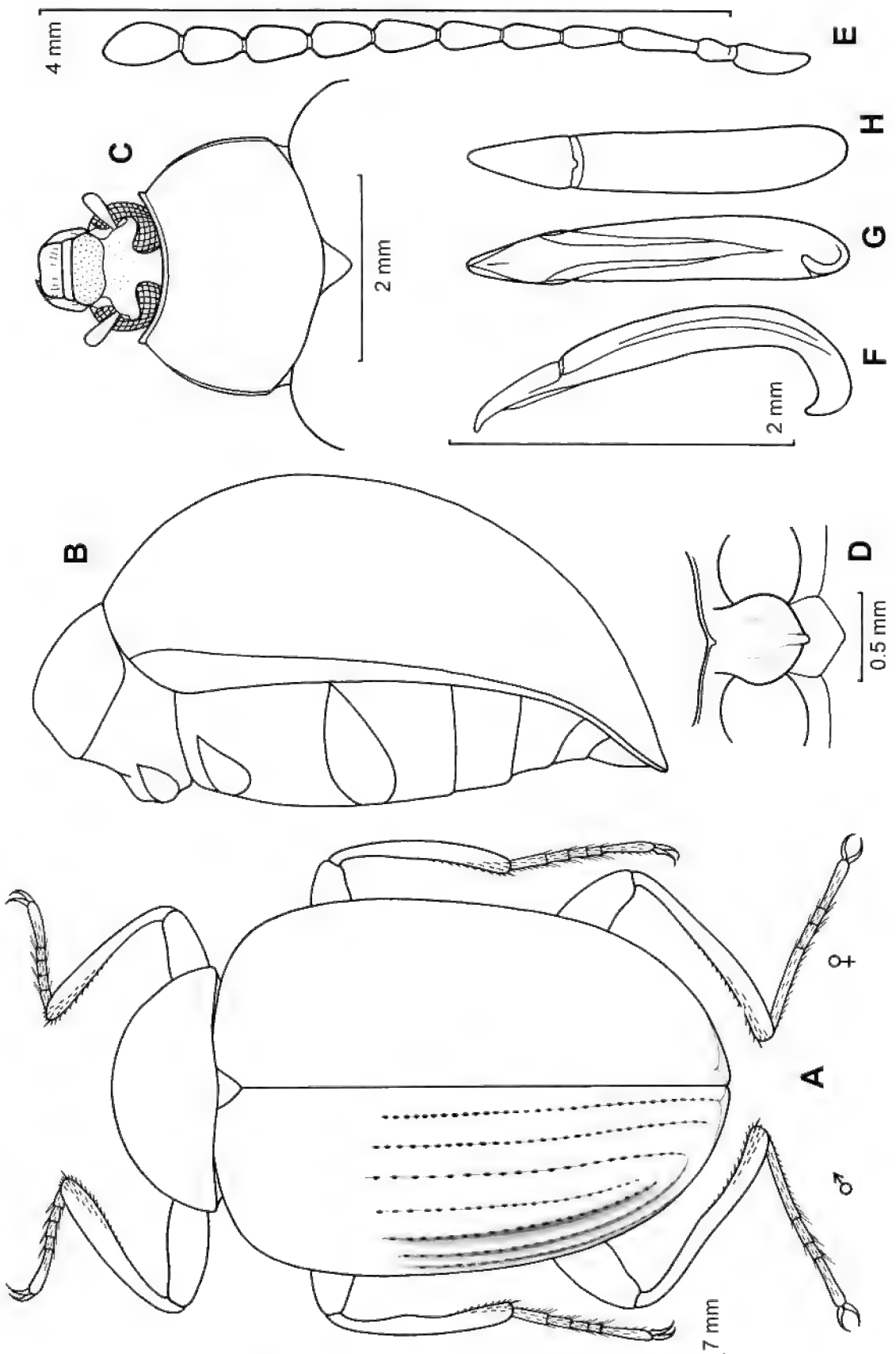


Fig. 15. *Amarygmus aeris* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

A. dignus Bremer, 2004 (Bremer 2004e: 113–116) frequently occurs in the same biotope. It is similar to *A. aeris*, but the upperside of *A. dignus* is greenish brown (ruby in *A. aeris*), and the males possess long hairs anteriorly on the profemora, on the back of the mesofemora, and on the prosternal apophysis (such hairs missing in *A. aeris*).

Description

Measurements: Body length 7.01–7.13 mm; body width 4.30–4.62 mm. – Ratios: Pronotum: width/length 1.67–1.75; width hind corners/width front corners 1.79–1.92. Elytra: length/width 1.29–1.39; length elytra/length pronotum 3.43–3.75; maximum width elytra/maximum width pronotum 1.54–1.59.

Colouration: Upperside ruby-coloured, lustrous. Femora black, lustrous (except profemora which are dark green and microreticulated), tibiae black, lustrous, tarsi dark brown. Antennae black. Underside black.

Head: Upperside flat except the raised genae. Frons of medium width, as wide as length of antennomere 4. Genae short, anteriorly terminating just behind the middle part of the fronto-clypeal suture. Fronto-clypeal suture markedly incised in its middle part, faintly incised in its lateral parts. Clypeus stretched forwards, somewhat convex transversely and longitudinally. Clypeus and frons with small, rather widely separated punctures. Mentum reversely trapezoidal, margins between base and sides rounded; lateral margins wide, flat, lustrous, space in between transversely convex and microreticulated. Mandibles on their outer surface with a sulcus, apically bifid.

Pronotum: Narrow, markedly convex transversely, distinctly convex longitudinally. Widest at base, anteriorly narrowing and bent. Front corners slightly prominent anteriorly, lateral borders forming a part of the front corners; hind corners strongly obtuse, nearly rounded. Anterior margin markedly excavated. Lateral and anterior margins bordered; border of the anterior margin wider than those of the lateral borders; lateral borders in dorsal view visible only in the hind three-fourths. Front corners in lateral view rectangular, hind corners strongly obtuse. Surface with very tiny, sparse punctures.

Scutellum: Triangular, narrow, sides slightly bent, impunctate.

Elytra: Somewhat oblong, oval, with prominent shoulders, markedly convex transversely and longitudinally. Maximum height and width at the level of the anterior third. Apices of elytra mutually rounded. Lateral edges not visible in dorsal view. With slightly incised striae with medium-sized, distinct, round, closely set punctures; approximately 34 punctures in row 4; in contrast to the male, not all punctures are linked by faint lines in the females. Intervals slightly convex in male, flat in female, with very tiny punctures.

Prosternum: Anterior margin narrowly bent upwards, very shortly retracted towards apophysis in the middle. Apophysis short, behind coxae descending and narrowing, only shortly protruded posteriorly; margins along procoxae shortly widened and raised, space in between without a marked groove; with a short, narrowly raised projection at the apex.

Mesosternum: Hind part short, wide; anterior margin slightly excavated in the middle.

Metasternum: Anterior margin between mesocoxae rounded, bordered. Anterior part of disc with some small punctures, posterior part with sparse, tiny punctures. Median line slightly incised on its hind part.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, narrowly bordered. Sternites impunctate, lustrous.

Antennae: Of medium length, similar in both sexes, reaching nearly to middle of elytra. Length/width ratio of antennomeres 1–11 equals to 20:8 / 10:6½ / 19:6½ / 17:6½ / 17:7 / 18:7½ / 19:10 / 18:10 / 20:10 / 19:10 / 23:11.

Legs: Of medium length. Femora distinctly surpassing lateral margins of body, with slender base, thickened towards the second third. Protibiae straight; mesotibiae on outer side slightly bent, in male with a slight bulge at about basal two-fifths on inner side and a small area of short, dense hairs in the apical fifth; metatibiae on outer side straight in the basal half, slightly incurved in the apical half; in male on inner side with a slight bulge at midlength. Lengths of protarsomeres 1–5 as 8:8:7:7:30, lengths of mesotarsomeres 1–5 as 21:14:9:8:30, lengths of metatarsomeres 1–4 as 40:10:8:32.

Aedeagus: See Fig. 15F–H.

Amarygmus affectus **n. sp.**
(Fig. 16A–H)

Holotype (sex not determined): Malaysia, Borneo, Sarawak, NW Kuching, Matang Wildlife Centre, 50–100 m, 16.–17.III.2008, R. Grimm (CG).

Paratypes: Same data as holotype (2 sex not determined CG). – Borneo, Malaysia, Sarawak, Kubah NP nr. Matang Wildlife Centre, 19.–22.IX.2008, R. Grimm (2 CG, 1 ZSMB, sex not determined). – Borneo, Malaysia, Sarawak, Kubah NP, Matang Wildlife Centre vic., 50–100 m, 28.–31.III.2009, R. Grimm (1 sex not determined CG). – Borneo, Malaysia, Sarawak, Kubah NP nr. HQ, 100–300 m, 15.–18.IX.2008, R. Grimm (1 sex not determined CG). – Same data as before, but 27.–28.III.2009, R. Grimm (1 CG, 1 ZSMB, sex not determined). – Malaysia, Borneo, Sarawak, Kubah NP, 250 m, 6.–8.III.2008, R. Grimm (1 ♀ CG, 1 ♀ ZSMB). – Same data as before, but 18.–19.III.2008 (1 ♂ ZSMB; 1 CG, 1 ZSMB, sex not determined).

Circumstances of collection: Edge of primary forest, on rotten stumps covered with fungi, at night.

Etymology

Afficior, affectum (Lat.) = link up with.

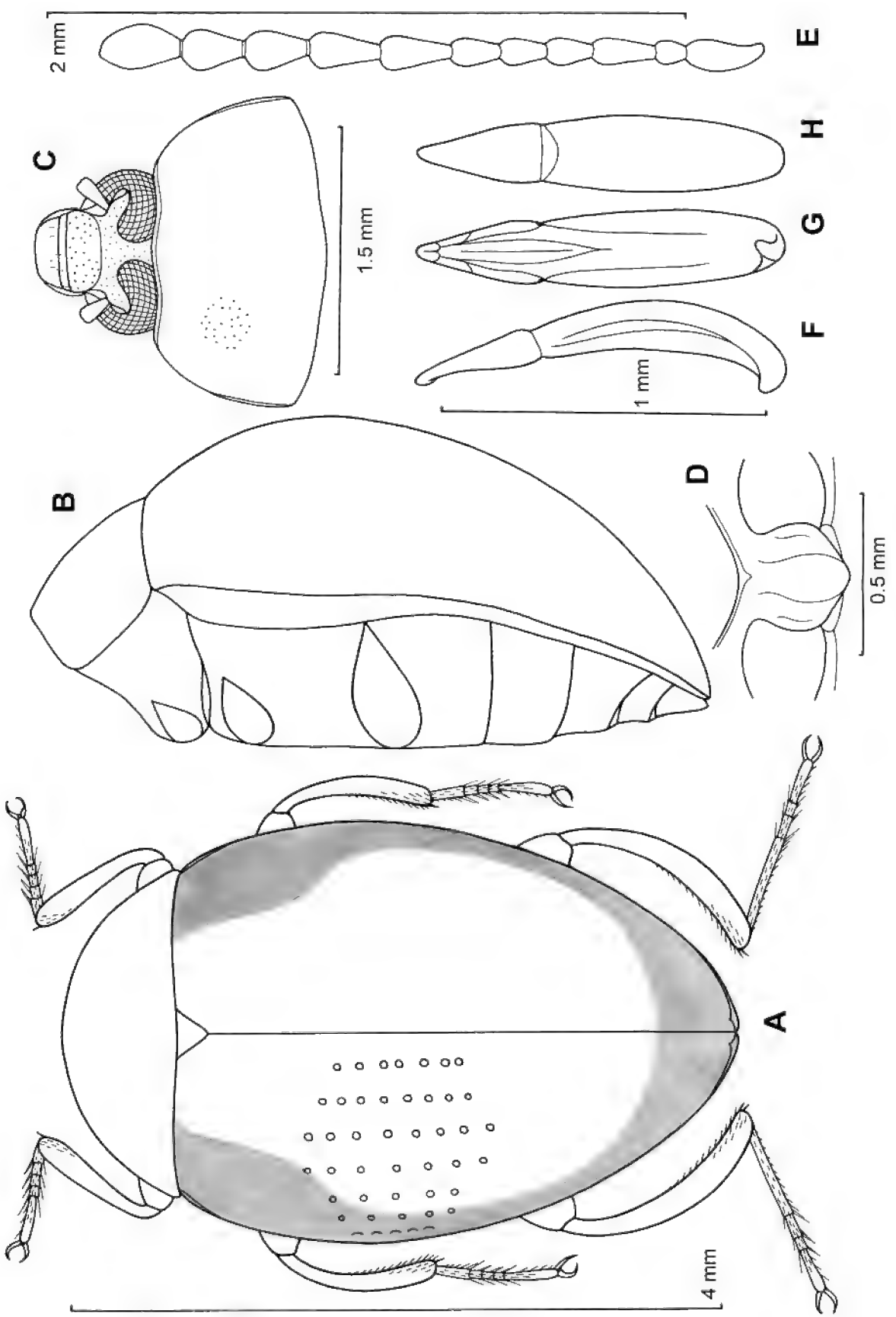


Fig. 16. *Amarygmus affectus* n. sp. – **A** Habitus, ♂ (shaded area of elytra blue), legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

Diagnosis

Small, oval, strongly convex, lustrous; lateral parts of elytra blue, disc of elytra reddish brown; legs and antennae brown. Maximum width and height of elytra at the level of the anterior third; elytra with rows of widely separated punctures; intervals flat, nearly impunctate. Frons relatively narrow. Antennae of medium length. Male protarsomeres 1–3 not widened. Underside of body bare in male. Male sternite 5 neither depressed nor excavated apicomedially.

Concerning shape and lack of noticeable sexual dimorphisms *A. affectus* belongs to the species group affine *A. splendidulus* (Fabricius, 1794) (redescribed by Bremer 2005b: 52–54).

A. jenisi Bremer, 2004, known only from the Cameron Highlands of the Malayan Peninsula (see Bremer 2004a: 46, fig. 28), has a similar shape, the lateral parts of the elytra blue, and the legs yellowish brown or brown. Another species with a blue lateral colouration of the elytra is *A. cinaediae* Bremer, 2004, known from Sarawak and Sumatra (see Bremer 2004e: 107–109). The two species differ from *A. affectus* as follows: *A. jenisi* is larger (body length 4.49–4.98 mm), its frons is markedly wider, the antennae are shorter, and the punctures of the elytral rows are smaller. *A. cinaediae* is also larger (body length 5.33–5.73 mm), its frons is markedly wider, and it has slightly incised striae on the elytra.

Description

Measurements: Body length 3.97–4.47 mm; body width 2.53–2.88 mm. – Ratios: Pronotum: width/length 1.98–2.05; width hind corners/width front corners 1.84–1.85. Elytra: length/width 1.25–1.32; length elytra/length pronotum 3.36–3.56; maximum width elytra/maximum width pronotum 1.28–1.33.

Colouration: Upperside strongly lustrous. Head green. Pronotum greenish with a distinct, golden tinge, slightly iridescent. Elytra laterally blue, disc reddish brown (border between blue and brown parts indistinct). Legs light brown to brown. Antennomeres 1–7 brown, 8–11 increasingly black (antennomere 11 apically brightened). Underside brown, lustrous, femora lighter brown than underside.

Head: Frons rather small, as wide as length of antennomere 2, situated somewhat higher than eyes, descending towards the somewhat depressed fronto-clypeal suture. Genae narrow, somewhat raised, anteriorly terminating at the level of the middle part of the fronto-clypeal suture. Fronto-clypeal suture distinctly depressed but scarcely incised. Clypeus stretched forwards, convex longitudinally, less convex transversely, with medium-sized, widely separated punctures; punctures of frons smaller. Mentum reversely trapezoidal, with a narrow base and slightly rounded basal corners; space between lateral margins convex transversely. Underside of neck with coarse, closely set punctures. Mandibles on their outer surface with a sulcus, apically bifid.

Pronotum: Wide, markedly convex transversely, less convex longitudinally. Widest at its base, anteriorly narrowing, bent. Anterior margin moderately excavated. Lateral and anterior margins continuously bordered, lateral borders in dorsal view visible only in the posterior three-fourths. Front corners in lateral view widely rounded, obtuse; hind corners less rounded, obtuse. Surface with very small, widely separated punctures.

Scutellum: Triangular, impunctate.

Elytra: Oval, strongly convex. Maximum width and height at the level of the anterior third. Shoulders indistinct. Apices of elytra mutually rounded. Lateral edges in dorsal view visible only on shoulders and apex. With rows of medium-sized, widely separated punctures; about 24 punctures in row 4. Intervals flat, with tiny punctures (visible at 50-fold magnification).

Prosternum: Anterior margin continuously and narrowly bent upwards, slightly retracted towards apophysis in its middle. Apophysis nearly as wide as long, rounded laterally, lateral margins raised; space between coxae with a wide groove with a longitudinal, low keel extending across the whole apophysis; apophysis broadly pointed on the apex.

Mesosternum: Hind part very wide, short; anterior margin slightly excavated in the middle.

Metasternum: Anterior margin between mesocoxae rounded, broadly bordered. Disc slightly convex transversely and longitudinally. Anterior part of disc with coarse, widely separated punctures, posterior part with very tiny and sparse punctures. Median line neither depressed nor incised.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, bordered. Sternites impunctate.

Antennae: Of medium length, reaching to anterior two-fifths of elytra, of the same length in both sexes. Length/width ratio of antennomeres 1–11 equals to 15:4 / 6:4 / 9:4 / 7:4 / 7:4 / 6½:4 / 10:6 / 11:6½ / 10:6½ / 9:6½ / 13:7.

Legs: Short. Femora markedly thickened towards the second third. Protibiae straight to slightly bent; meso- and metatibiae clearly bent. Protarsomeres 1–3 not widened in males. Lengths of protarsomeres 1–5 as 4:4:4:4:16, lengths of mesotarsomeres 1–5 as 7:5:4:4:17, lengths of metatarsomeres 1–4 as 31:11:6:16.

Aedeagus: See Fig. 16F–H.

Amarygmus assessorius **n. sp.**
(Fig. 17A–H)

Holotype (♂): Sabah, Borneo, vic. Ranau, ad lucem, 22.IV.2007, S. Chew leg. (ZSMB).

Circumstances of collection: No information except at light, at night.

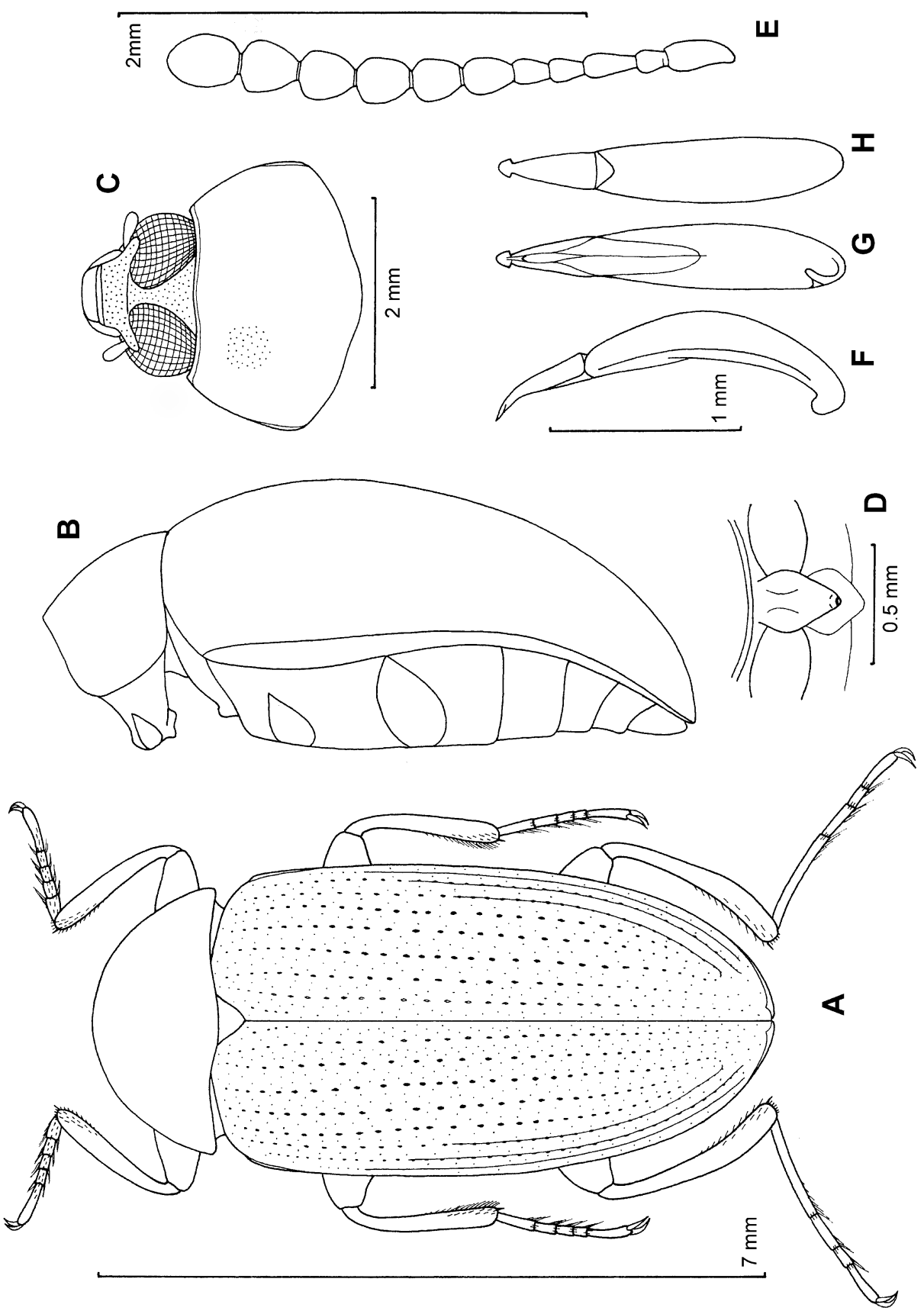


Fig. 17. *Amarygmus assessorius* n. sp. – **A** Habitus, ♂. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

Etymology

Assessorius (Lat.) = adjective of assessor.

Diagnosis

Of medium size, elytra oblong and slightly oval, strongly convex transversely. Pronotum nearly as wide as elytra. With rows of medium-sized, indistinct punctures on elytra which are partially linked by faint lines. Frons rather narrow, antennae short. Protarsomeres 1–3 slightly widened in male.

Amarygmus assessorius n. sp. belongs to a group of species which formerly was assigned to *Elixota*, a genus which was synonymized with *Amarygmus* by BREMER (2001a) because of the many transitional forms towards *Amarygmus*. Within this group, *A. assessorius* can be compared with *A. hilaratus* Bremer, 2007 (BREMER 2007a: 5–17) and *A. viridicatus* Bremer, 2004 (BREMER 2004a: 51, fig. 32), both from Sabah. *A. hilaratus* is larger than *A. assessorius*, the frons is wider, the punctures of the elytral rows are very closely set, the males possess an area of short hairs anteriorly on the profemora, and the apex of the aedeagus is not so abruptly enlarged as in *A. assessorius*. *A. viridicatus* shows a similar shape, but this species has striae on the elytra while *A. assessorius* has rows of punctures.

Description

Measurements: Body length 6.85 mm; body width 3.14 mm. – Ratios: Pronotum: width/length 1.68; width hind corners/width front corners 1.55. Elytra: length/width 1.82; length elytra/length pronotum 3.60; maximum width elytra/maximum width pronotum 1.18.

Colouration: Upperside green, somewhat opaque because of microreticulation. Legs dark brown, tarsomeres brown. Antennomeres 1–3 dark brown, 4–11 black. Underside brown, metasternum slightly lustrous, sternites more opaque.

Head: Frons rather narrow, its width approximately corresponding to length of antennomere 4. Eyes very large, occupying most of the surface of the head. Genae narrow, slightly raised, anteriorly terminating anterior to the level of the middle part of the fronto-clypeal suture. Fronto-clypeal suture situated just in front of the eyes, in its middle part narrowly incised and depressed, not visible laterally. Clypeus slightly stretched forwards. Clypeus and frons with tiny, indistinct punctures. Mentum reversely trapezoidal, lateral margins flat, lustrous, space in between transversely convex. Underside of neck with coarse, closely set punctures. Mandibles on their outer surface with a sulcus, apically bifid.

Pronotum: Nearly as wide as elytra, markedly convex transversely, slightly convex longitudinally. Lateral margins narrowing anteriorly, bent. Front corners in dorsal view not visible. Anterior margin slightly excavated. Lateral margins and anterior margin continuously bordered. Lateral borders in dorsal view narrowly visible only in the posterior half. Front and hind corners in lateral view narrowly rounded, obtuse. Surface with minute, moderately closely set punctures.

Scutellum: Triangular, without punctures.

Elytra: Oblong, slightly oval, markedly convex transversely, less convex longitudinally. Maximum width just behind shoulders, maximum height slightly anterior to the middle. Shoulders prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view visible only at the shoulders. With rows of small, slightly elongate, not very distinct punctures which are not connected by lines on the disc; punctures of row 6 connected by faint lines, punctures of rows 7+8 situated in incised striae. Intervals 1–6 flat, 7–8 slightly convex, all intervals impunctate.

Prosternum: Apophysis very narrow; apically pointed and bent upwards, between coxae with a deep and narrow groove.

Mesosternum: Hind part with raised, granulated lateral margins; central part lower, smooth; anterior margin excavated in the middle.

Metasternum: Anterior part of disc with small punctures, posterior part nearly impunctate. Median line incised on the whole length.

Sternites: Sternites nearly impunctate. Sternite 5 apicomedially slightly depressed in male.

Antennae: Short, reaching to anterior fifth of elytra. Length/width ratio of antennomeres 1–11 equals to 11:6 / 7:5 / 11:5 / 8:5 / 8:5½ / 10½:7 / 10:10 / 12:10½ / 12:10½ / 12:11 / 16:11.

Legs: Short. Femora thickened towards the second third. Protibiae nearly straight, mesotibiae slightly bent, metatibiae markedly bent. Protarsomeres 1–3 slightly widened in male. Lengths of protarsomeres 1–5 as 12:9:7:6:24, lengths of mesotarsomeres 1–5 as 19:13:9:8:24, lengths of metatarsomeres 1–4 as 48:21:11:25.

Aedeagus: See Fig. 17F–H.

Amarygmus assignatus **n. sp.**

(Fig. 18A–H)

Holotype (♂): Borneo, Malaysia, Sabah, Kinabalu NP, HQ vic., 1550 m, 11.–13.II.1006, R. GRIMM (CG).

Paratypes: Same data as holotype (1 ♂ ZSMB). – Borneo, Malaysia, Sabah, Gunung Emas, 1400 m, 4.II.2006, R. GRIMM (1 ♀ CG). – Keningau, Sabah, 10.V.1981, M. TAO leg. (1 ♀ CM).

Circumstances of collection: Edge of mountainous primary forest, at night (in Gunung Emas).

Etymology

Assignavi, assignatum (Lat.) = assign to.

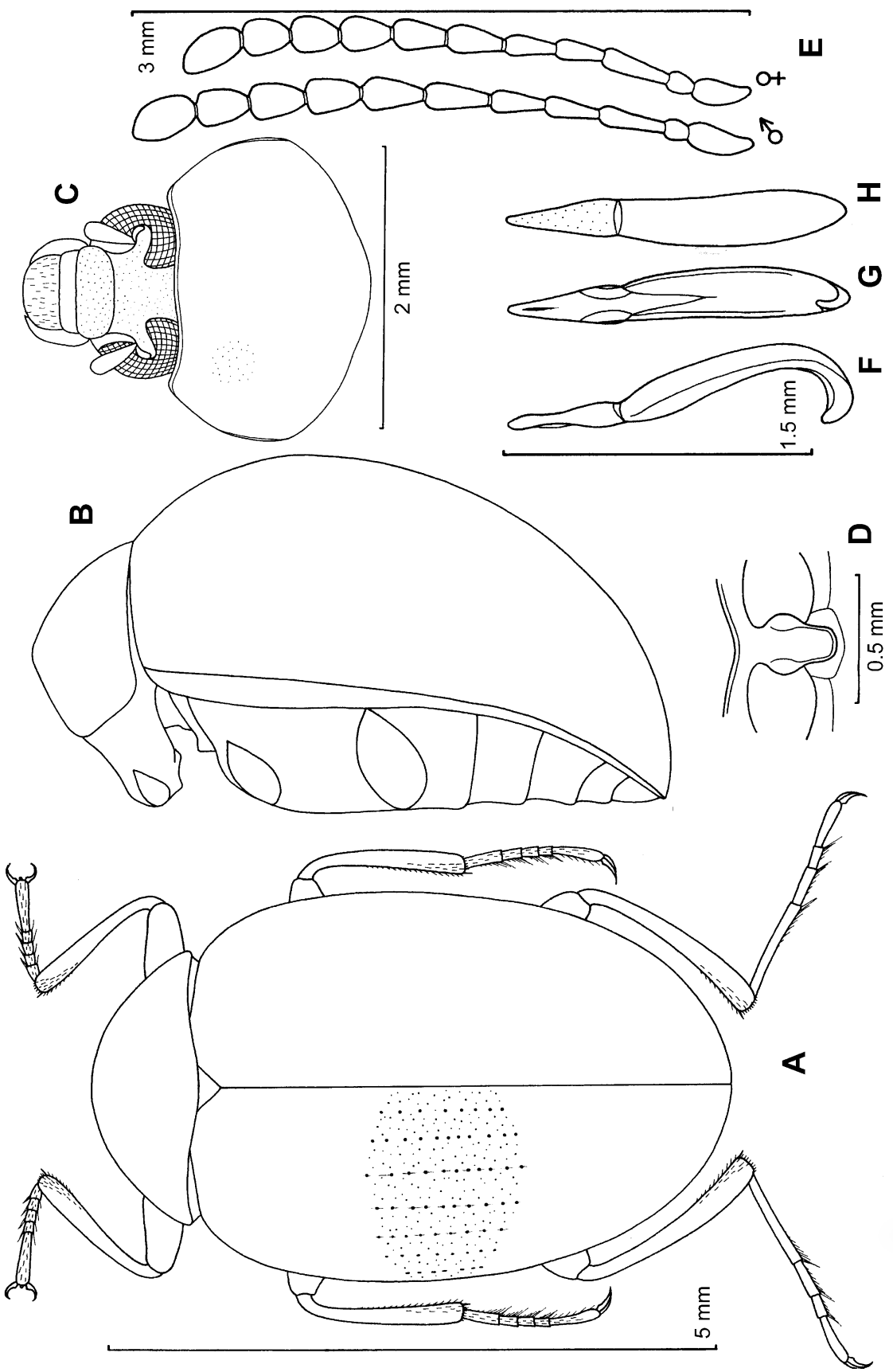


Fig. 18. *Amarygmus assignatus* n. sp. – **A** Habitus, ♂. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antennae ♂ and ♀. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

Diagnosis

Small, oval, slightly elongate, strongly convex transversely. Elytra with rows of small punctures. Metatibiae posteriorly with some short bristles in both sexes. Antennae rather long, in males somewhat longer than in females. Protarsomeres 1–3 not widened in males. Pronotum greenish blue, elytra bronze-coloured, legs light brown.

With respect to size and shape *A. assignatus* n. sp. shows a certain similarity to *A. venustus* Bremer, 2002 (Bremer 2002a: 49) from the Malayan Peninsula and to *A. bryanti* Bremer, 2002 (Bremer 2002a: 20) from Sarawak and the Malayan Peninsula. However, in *A. venustus* and *A. bryanti* the frons is narrower and the antennae are longer than in *A. assignatus*, the upperside is more colourful (*A. venustus* has a blue pronotum and dark green elytra with red and yellow reflections; *A. bryanti* has a greenish blue pronotum and the elytra with a slight sericeous shine and golden, bluish and red reflections), and the tibiae are dark brown to black (brown in *A. assignatus*). Additionally, *A. bryanti* has very short recumbent hairs on the pronotum (bare in *A. assignatus*).

For differential diagnosis, *A. praestans* Bremer, 2002 (Bremer 2002a: 32) from Sabah and Sarawak has to be considered, too. In *A. praestans* the width of the frons, the length of the antennae and the colour and shape of the legs are similar to *A. assignatus*, but *A. praestans* has a uniformly yellow antennomere 11, is somewhat smaller (body length 4.14–4.66 mm), and the elytra are more convex longitudinally.

Description

Measurements: Body length 5.02–5.41 mm; body width 2.88–3.23 mm. – Ratios: Pronotum: width/length 1.65–1.73; width hind corners/width front corners 1.64–1.72. Elytra: length/width 1.47–1.51; length elytra/length pronotum 3.39–3.70; maximum width elytra/maximum width pronotum 1.39–1.40.

Colouration: Head black. Pronotum bluish green, lustrous. Elytra bronze, lustrous. Legs light brown. Antennomeres 1–5 light brown, 6 darker brown, 7–11 black (antennomere 11 apically brightened). Underside brown, slightly lustrous.

Head: Frons of medium width, corresponding to length of antennomere 3. Genae slightly raised, very short, narrow, anteriorly terminating clearly behind the middle part of the fronto-clypeal suture. Fronto-clypeal suture arched, markedly but not deeply incised in its whole width. Clypeus stretched forwards, somewhat convex transversely. Clypeus and frons with sparse, small punctures. Mentum reversely trapezoidal, rather flat. Underside of neck strongly microreticulated, anteriorly with a few small punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Narrow, the lateral outline following the outline of the elytra, strongly convex transversely, less but still markedly convex longitudinally. Lateral margins narrowing anteriorly, bent. Front corners depressed downwards, rounded. Anterior margin nearly straight. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view visible. Front corners in lateral view with an angle of approximately 100°, hind corners more obtuse. Surface with indistinct, small, sparse punctures.

Scutellum: Triangular, impunctate.

Elytra: Ovate, strongly convex transversely and longitudinally. Maximum height and width at the level of the anterior third. Shoulders rounded. Apices of elytra mutually rounded. Lateral edges not visible in dorsal view. With rows of indistinct, small punctures which are not very closely set; on disc some punctures are connected by very faint lines. Intervals flat, with sparse, tiny punctures.

Prosternum: Anterior margin narrowly bent upwards, scarcely retracted towards apophysis in the middle. Apophysis not very wide, margins along procoxae somewhat widened and raised like a knob, behind coxae somewhat descending and with subparallel margins, apex straight.

Mesosternum: Hind part narrow; anterior margin slightly excavated.

Metasternum: Anterior margin between mesocoxae narrowly rounded, bordered. Disc with very small sparse punctures which are the origin of short recumbent hairs. Median line slightly depressed.

Sternites: Impunctate (at 50-fold magnification), on discs with some tiny recumbent hairs.

Antennae: Antennae reaching middle part of elytra in males and anterior two-fifths in females. Length/width ratio of antennomeres 1–11 in male equals to 14:7 / 8:5½ / 18:5 / 11:5 / 12:5½ / 15:6½ / 13:7 / 13:7½ / 12:8 / 12:8 / 17:8½, in female to 13:6 / 8:5 / 18:5 / 11:5 / 12:5 / 12:6 / 12:6½ / 13:7 / 11½:7½ / 11½:8 / 16:8½.

Legs: Short, slender. Femora flattened, slightly thickened towards the second third. Protibiae straight. Mesotibiae somewhat bent in the basal half, straight in the apical half. Metatibiae in the apical half more bent than in the basal half. Lengths of protarsomeres 1–5 as 5:5:5:5:20, lengths of mesotarsomeres 1–5 as 11:9:8:6:20, lengths of metatarsomeres 1–4 as 38:16:10:20.

Aedeagus: See Fig. 18F–H.

Amarygmus catenatus **n. sp.**

(Fig. 19A–H)

Holotype (♂): Malaysia, Sabah, Crocker Range, Gunung Emas, 1350 m, 20.XI.2006, R. Grimm (CG).

Paratypes: Borneo, Malaysia, Sabah, Crocker Range, Gunung Emas, 1500 m, 1.IV.2007, R. Grimm (1 ♂ ZSMB). – Borneo, Malaysia, Sabah, Kinabalu NP, HQ vic., 1550 m, 11.–13.II.2006, R. Grimm (1 ♀ ZSMB).

Circumstances of collection: Edge of mountainous primary forest, at night.

Etymology

Catenatus (Lat.) = closely connected.

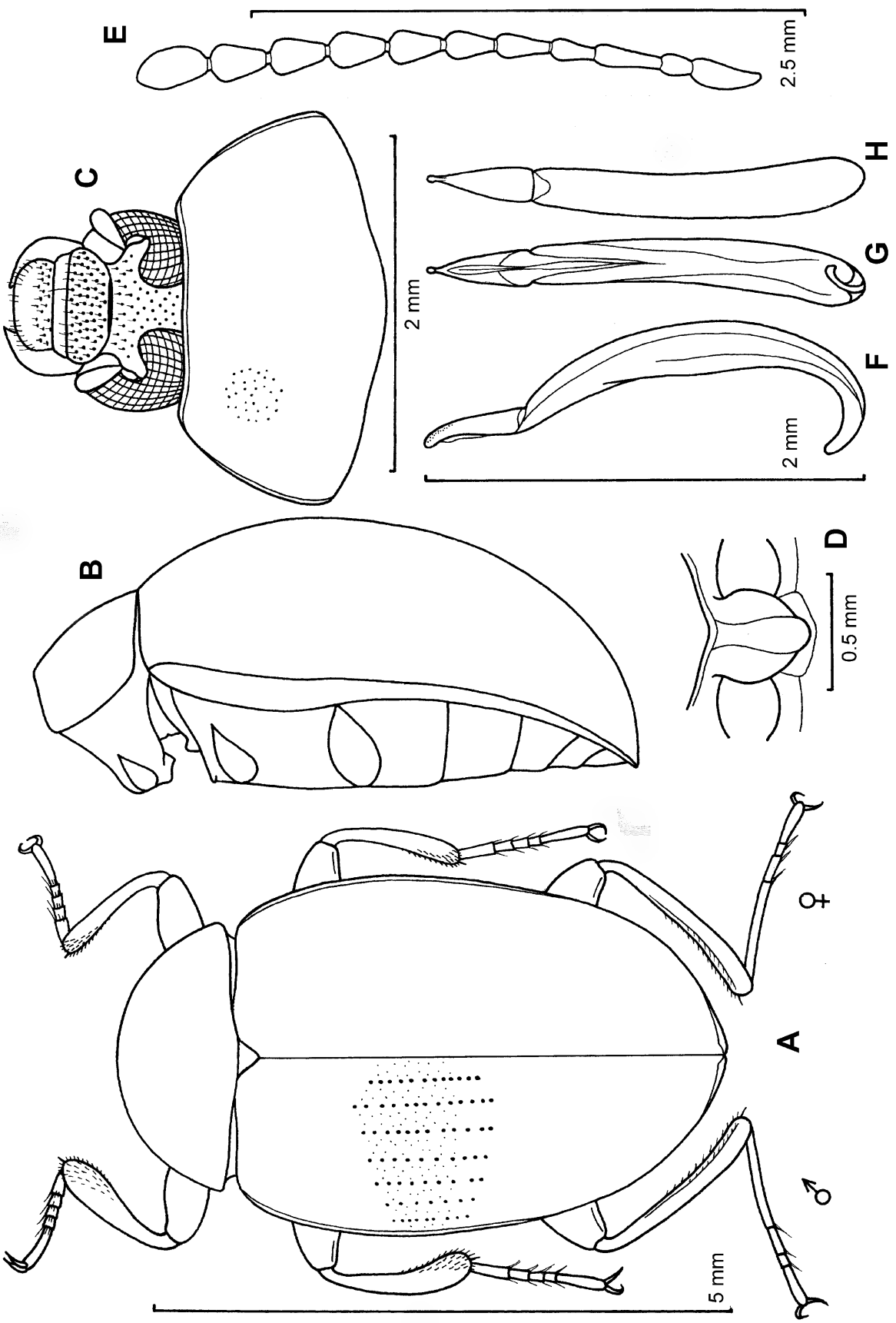


Fig. 19. *Amarygmus catenatus* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

Diagnosis

Small, lustrous. Body oval and somewhat elongate. Elytra with rows of small punctures. Frons of medium width. Antennae not very long. Male pro- and mesotibiae widened in apical half on inner side. Upperside coppery, femora and tibiae dark brown or black. Metatarsomere 1 relatively long.

Showing the same size and the same modification of the male legs, *A. catenatus* n. sp. is similar to *A. sodalis* Bremer, 2002 (Bremer 2002a: 42) from Sabah. However, *A. sodalis* has reddish brown femora and tibiae (black in *A. catenatus*), smaller punctures of the elytral rows, very tiny and widely separated punctures of the elytral intervals (in *A. catenatus* also tiny but the punctures more distinct and closer set), and the maximum width and height of the elytra in or slightly anterior to the middle (in *A. catenatus* at the level of the anterior third).

A certain similarity also exists between females of *A. catenatus* and *A. platypodes* n. sp. However, in *A. platypodes* the female protibiae are strictly straight and slightly widened on inner side (weakly bent in *A. catenatus*), the terminal antennomeres are shorter and the frons is wider. The male sexual characters of the protibiae are very different in both species (see Figs. 19A and 43A).

Description

Measurements: Body length 4.75–5.25 mm; body width 2.72–2.96 mm. – Ratios: Pronotum: width/length 1.90–2.07; width hind corners/width front corners 1.75–1.87. Elytra: length/width 1.38–1.50; length elytra/length pronotum 3.60–3.96; maximum width elytra/maximum width pronotum 1.28–1.35.

Colouration: Upperside lustrous. Head coppery. Pronotum dark coppery or blackish blue. Elytra coppery. Underside including underside of neck brown, lustrous. Basal half of femora brown, apical half darker brown to black, tibiae dark brown to black, tarsi brown.

Head: Frons of medium width, of the same width in both sexes, somewhat narrower than length of antennomere 3 (like 12 : 14). Genae somewhat raised, anteriorly terminating at the level of the middle part of the fronto-clypeal suture. Fronto-clypeal suture arched, depressed and slightly incised. Clypeus markedly stretched forwards, somewhat convex transversely and longitudinally. Clypeus and frons with small, rather closely set punctures; short hairs originating from clypeal and genal punctures. Mentum lustrous, markedly widened anteriorly, lateral margins slightly bent and flat, space in between transversely convex. Underside of neck with coarse punctures which are aligned crossways. Mandibles on their outer surface with a sulcus, apically bifid.

Pronotum: Markedly convex transversely, less convex longitudinally. Lateral margins narrowing anteriorly, bent. Front corners narrowly rounded. Anterior margin slightly excavated. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view very narrowly visible. Front corners in lateral view rounded, about rectangular; hind corners angular, obtuse. Surface with small, not very densely but irregularly set punctures.

Scutellum: Triangular, impunctate.

Elytra: Oval, somewhat elongate, markedly convex transversely, clearly convex longitudinally. Maximum height and width at the level of the anterior third. Shoulders slightly prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view narrowly visible. With rows of small punctures which are partially linked by very faint lines; distance between punctures on disc in row 4 about 1–3 times diameter of a puncture; approximately 35 punctures in row 4. Intervals with tiny, distinct, not very closely set punctures.

Prosternum: Anterior margin narrowly bent upwards laterally, in the middle with an extension which continues into a low keel towards apophysis; this keel extends across the whole apophysis and is widend posteriorly. Apophysis along procoxae widened and lateral margins somewhat raised, space in between with a shallow groove; lateral margins behind coxae narrowing, roundedly extending into the apex which presents a slightly protruded tip in the middle.

Mesosternum: Anterior margin excavated; apart from that without structural peculiarities.

Metasternum: Anterior margin between mesocoxae rounded, bordered. Apophysis anteriorly bordered by the anterior margin, somewhat raised like a hunch. Anterior part of disc with some medium-sized punctures, posterior part with some very small punctures. Median line slightly incised in the posterior half.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, bordered. Sternites impunctate. Sternite 5 apicomedially depressed in males.

Antennae: Relatively short, reaching to anterior fourth of elytra, of the same length in both sexes. Length/width ratio of antennomeres 1–11 equals to 11:5 / 7:4½ / 14:5 / 10:5 / 12:5 / 11:7½ / 12:8 / 12:8 / 12:8½ / 11:8½ / 16:8½.

Legs: Short. Femora thickened towards the second third. Protibiae on outer side somewhat bent, on inner side markedly widened in males, only very slightly widened in females; mesotibiae bent, in males with an area of closely set, semi-erect hairs apically on inner side; metatibiae straight in the basal half, slightly incurved in the apical half. Protarsomeres 1–3 not widened in males. Lengths of protarsomeres 1–5 as 8:5:5:4:18, lengths of mesotarsomeres 1–5 as 14:9:7:6:28, lengths of metatarsomeres 1–4 as 36:12:5:18.

Aedeagus: See Fig. 19F–H.

Amarygmus cephalotes **n. sp.**
(Fig. 20A–I)

Holotype (♂): Borneo, Malaysia, Sabah, Keningau, 300 m, 20.–22.III.2007, R. GRIMM (CG).

Paratypes: Borneo, Sabah, S Keningau, 350 m, 20.–22.III.2007, leg. W. SCHAWALLER (1 ♂ SMNS). – Malaysia, Borneo, Sarawak, NW Kuching, Matang, 17.III.2008, R. GRIMM (1 ♂, 1 ♀ CG; 1 ♂ ZSMB). – Malaysia, Borneo, Sarawak, Kuching, Reservoir Park, 50 m, 4.–5.III.2008, R. GRIMM (2 ♂♂ CG, 2 ♂♂ ZSMB, 1 ♀ CG). – Bornéo Occ., Menterado, J. B. LEDRU 1897 (1 ♀ MNHN). – S Thailand, Betong, Gunung Cang Dun Vill., Yala Dist., 25.III.–22.IV.1992, J. HORÁK (1 ♂ ZSMB).

Circumstances of collection: On tree bark in parks (in Keningau and Kuching), at night.

Etymology

Cephalotes from Greek ἡ κεφαλ·ή = head.

Diagnosis

Small, oval. Characterized by a peculiar shape of the head (fronto-clypeal suture incised like a deep and wide groove, frons and genae forming a common arched border towards this groove). Elytra with rows of small punctures. Upperside dark coppery to black. Mesofemora with short bristles posteriorly, mesotibiae in males with widely separated long hairs on inner side.

A similar shape of head is known from *A. straumanni* Bremer, 2001 (BREMER 2001c: 4–5, fig. 1) from Singapore, Sarawak, and Sabah. *A. straumanni* is smaller than *A. cephalotes* (body length 2.84–3.74 mm), its elytra are narrower, the elytral colour is greenish golden, the legs are yellowish brown, the pronotum is more intensively blue, and the punctures of the elytral rows are markedly smaller.

Description

Measurements: Body length 4.09–4.36 mm; body width 2.49–2.72 mm. – Ratios: Pronotum: width/length 2.00–2.16; width hind corners/width front corners 1.69–1.81. Elytra: length/width 1.29–1.34; length elytra/length pronotum 3.50–3.72; maximum width elytra/maximum width pronotum 1.30–1.32.

Colouration: Upperside black to dark coppery, lustrous; pronotum may present a bluish tinge. Femora and tibiae dark brown to black; tarsi light brown. Antennae black. Underside dark brown, lustrous.

Head: Frons of medium width, somewhat narrower than length of antennomere 3 (like 12 : 14), with very small, irregularly set punctures. Genae not raised, forming together with the frons an arched limit towards the groove-like fronto-clypeal suture. Clypeus slightly stretched forwards, convex longitudinally, with very small and sparse punctures and with some very short hairs. Mentum reversely trapezoidal, with wide, flat lateral margins; space in between convex. Underside of neck with coarse punctures which are partially aligned crossways. Mandibles apically bifid.

Pronotum: Wide, uniformly convex transversely, slightly convex longitudinally. Lateral margins narrowing anteriorly, nearly straight. Anterior margin slightly excavated. Front corners not projecting. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view very narrowly visible. Front and hind corners in lateral view about rectangular. Surface with tiny, widely separated punctures.

Scutellum: Triangular, impunctate.

Elytra: Oval, markedly convex. Maximum height and width at the level of the anterior third. Shoulders rounded. Apices of elytra mutually rounded. Lateral edges not visible in dorsal view. With rows of medium-sized punctures; distance between punctures on disc in row 4 about 2–3 times diameter of a puncture; about 23 punctures in row 4; punctures in rows 1 and 2 closer set than in the subsequent rows. Intervals flat, impunctate.

Prosternum: Anterior margin narrowly bent upwards; retracted towards apophysis in its middle, forming a short keel. Apophysis narrow anteriorly, widened towards apex; sides at apex shortly retracted towards middle posteriorly, in its middle narrowly projecting, space between procoxae with a shallow groove.

Mesosternum: Anterior margin excavated in its middle; surface with some long hairs.

Metasternum: Anterior margin between mesocoxae rounded, bordered. Anterior half of disc with medium-sized punctures and (in males) long hairs which originate from these punctures, posterior half with very small, sparse punctures; disc somewhat convex, without a visible median line.

Sternites: Discs of sternites with small punctures and moderately long hairs. Sternite 5 apicomedially somewhat depressed in males, around this depression with recumbent, tender hairs of medium length.

Antennae: Of medium length, reaching to anterior third of elytra. Antennae of females somewhat shorter than those of males. Antennal segments 6–11 enlarged. Length/width ratio of antennomeres 1–11 in male equals to 11:4½ / 7:4 / 14:4 / 8:4 / 8:4½ / 10:6 / 10:7 / 11:7½ / 10½:7½ / 10:7½ / 14:8, in female to 10:4½ / 7:4 / 11:4 / 7½:4 / 7½:4½ / 8:5½ / 9:7 / 10:7 / 9:7 / 9:7 / 13:7½.

Legs: Short. Femora thickened towards the second third. For pilosity of mesofemora and mesotibiae see diagnosis. Protibiae very slightly bent, mesotibiae bent, metatibiae markedly bent. Protarsomeres 1–3 slightly widened in males. Lengths of protarsomeres 1–5 as 5:5:4:3:14, lengths of mesotarsomeres 1–5 as 10:6:5:4:16, lengths of metatarsomeres 1–4 as 23:9:4:14.

Aedeagus: See Fig. 20G–I.

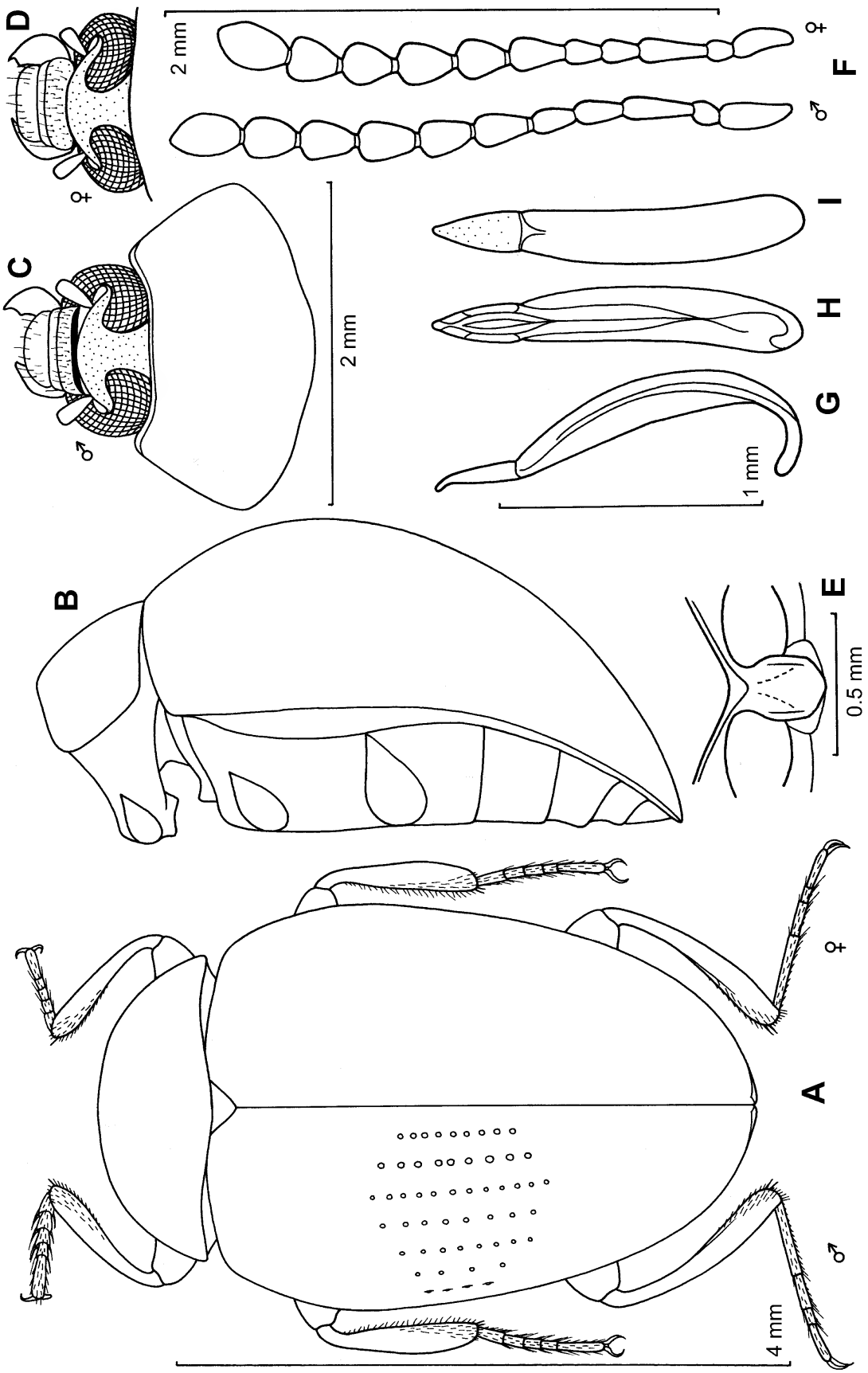


Fig. 20. *Amarygmus cephalotes* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum ♂. **D** Head ♀. **E** Prosternal apophysis. **F** Antennae ♂ and ♀. **G** Aedeagus, lateral view. **H** Aedeagus, ventral view. **I** Aedeagus, dorsal view.

Amarygmus coccinelloides **n. sp.**
(Fig. 21A–E)

Holotype (sex not determined): Borneo, Malaysia, Sabah, Crocker Range, Gunung Emas, 1500 m, 16.–17.III.2007, R. GRIMM (CG).

Paratypes: Borneo, Sabah, Crocker Mts., 500–1900 m, Gunung Emas, 6.–21.V.1995, IVO JENIŠ leg. (2 damaged, sex not determined ZSMB).

Circumstances of collection: Mountainous primary forest, on tree bark, at night.

Etymology

Coccinelloides, similar to small *Coccinella* species.

Diagnosis

Tiny, strongly convex transversely, oval. Elytra bright red, with a black macula on each elytron, giving this species the appearance of a small *Coccinella*. Frons wide, antennae of medium length. Elytra with rows of punctures.

The very characteristic elytral pattern, similar to Coccinellidae or Leiochrini (Tenebrionidae), makes this species unmistakable.

Description

Measurements: Body length 2.99–3.10 mm; body width 1.83–1.87 mm. – Ratios: Pronotum: width/length 1.78–2.02; width hind corners/width front corners 1.57–1.75. Elytra: length/width 1.38–1.40; length elytra/length pronotum 3.57–3.88; maximum width elytra/maximum width pronotum 1.35–1.42.

Colouration: Elytra bright red; on each elytron in its middle part a black, elongate macula. Pronotum black, lustrous, in the middle of the basal margin lightened. Clypeus and anterior part of frons brown, lustrous, posterior part of frons dark brown. Underside light brown, lustrous. Legs yellowish brown. Antennomeres 1–5 yellowish brown, 6 brown, 7–11 black.

Head: Frons wide, twice as wide as length of antennomere 3, with very sparse and small punctures. Genae short, slightly convex. Fronto-clypeal suture somewhat arched, incised. Clypeus moderately stretched forwards, slightly convex transversely and longitudinally; bright, short, slightly bent hairs originating from the small and sparse punctures. Mentum reversely trapezoidal, with slightly bent lateral margins. Mandibles on their outer surface with a sulcus, apically bifid.

Pronotum: Wide, uniformly convex transversely, less convex longitudinally. Widest at base, sides narrowing anteriorly, bent. Front corners not projecting forwards. Anterior margin straight. Lateral and anterior margins bordered. Lateral borders in dorsal view visible only in their hind half. Front and hind corners in lateral view slightly obtuse. Surface with small, sparse, indistinct punctures.

Scutellum: Triangular, impunctate.

Elytra: Of half-elliptic shape, strongly convex. Maximum height and width slightly behind level of the anterior third. Shoulders not prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view visible in the posterior sixth. With rows of indistinct, medium-sized punctures; distance between punctures on disc in row 4 about 2 times diameter of a puncture; about 18 punctures in row 4. Intervals flat, impunctate.

Prosternum: Anterior margin narrowly bent upwards, markedly retracted towards apophysis in its middle. Apophysis wide, short; markedly widened along procoxae, space in between with a wide groove, the bottom of this groove in its middle interrupted by a low keel which extends across the whole apophysis; margins behind coxae narrowed; apex rounded, but with a short cone in its middle.

Mesosternum: Hind part wide, short; anterior margin shallowly excavated in the middle, with a longitudinal groove laterally.

Metasternum: Anterior margin between mesocoxae rounded, bordered. Disc behind the anterior margin with some small punctures, otherwise impunctate. Median line incised.

Sternites: Impunctate, lustrous.

Antennae: Of medium length, reaching to anterior fourth of elytra. Antennal segments 6–11 markedly enlarged. Length/width ratio of antennomeres 1–11 equals to 8:4 / 5:3 / 8:2½ / 4½:2½ / 5½:3 / 6:4 / 6:4½ / 6½:4½ / 6:4½ / 6:4½ / 9:4½.

Legs: Short. Femora thickened towards the second third. Protibiae straight, thickened apically; meso- and metatibiae slightly bent. Lengths of protarsomeres 1–5 as 3:3:2½:2½:11, lengths of mesotarsomeres 1–5 as 7:4:3½:2:12, lengths of metatarsomeres 1–4 as 24:8:5:12.

Amarygmus cyamias **n. sp.**
(Fig. 22A–H)

Holotype (♂): Sabah, Keningau, 400 m, nachts, auf der Rinde von Bäumen, 17.II.2006, H. J. BREMER leg. (ZSMB).

Circumstances of collection: On the bark of a tree in a garden, at night.

Etymology

Cyamias, name of a precious stone in the "Naturalis historia" of PLINIUS senior. It is unknown which precious stone was meant.

Diagnosis

Small. Elytra short and markedly convex, lustrous; upperside colourful iridescent. Elytra with rows of small punctures. Frons wide, antennae short. Shape and colour resemble a small Chrysomelidae.

A. cyaneicollis n. sp. from Sabah has the same size, shape and width of frons as *A. cyamias* n. sp. (see below),

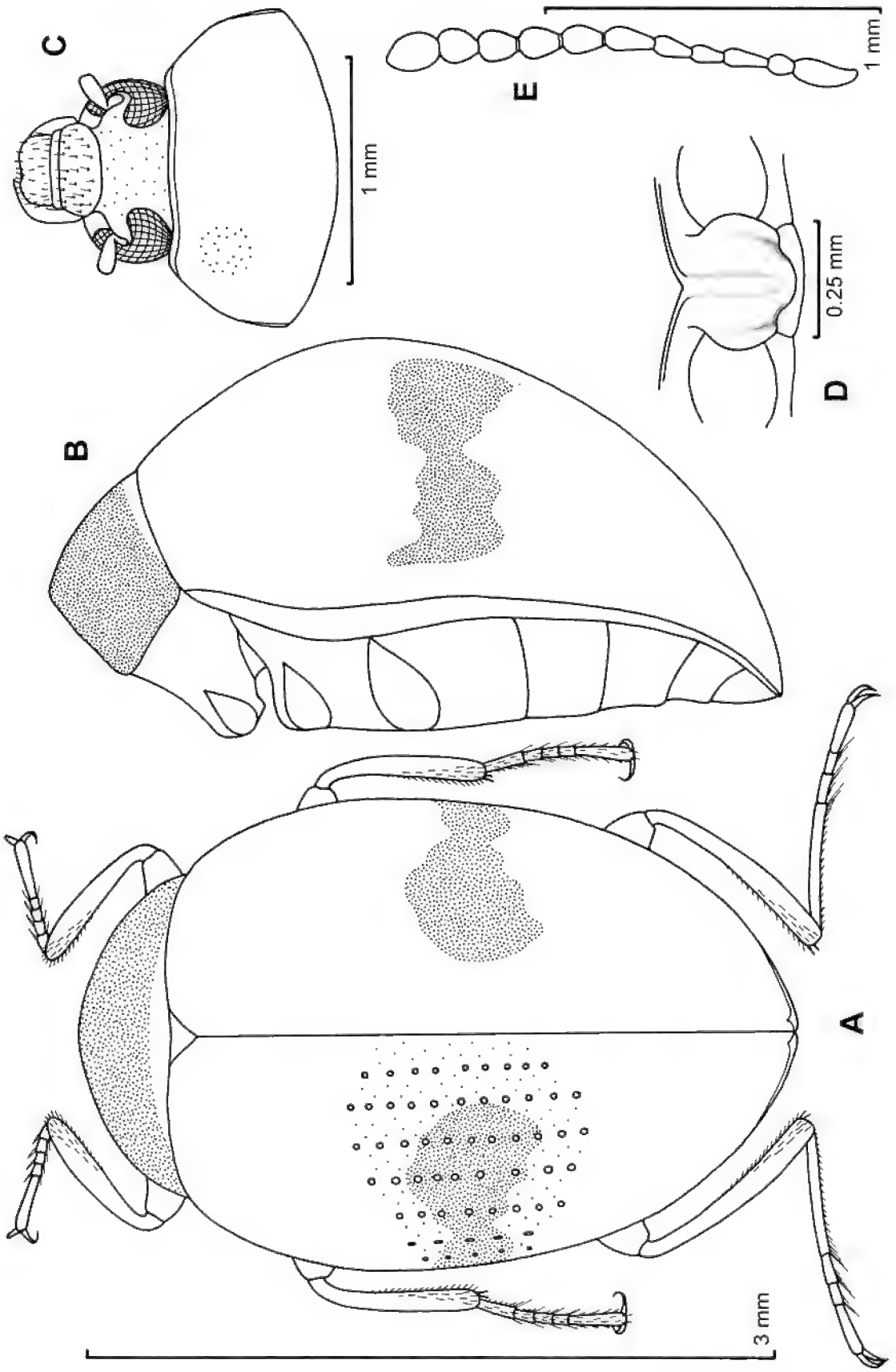


Fig. 21. *Amarygmus coccinelloides* n. sp. – **A** Habitus. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna.

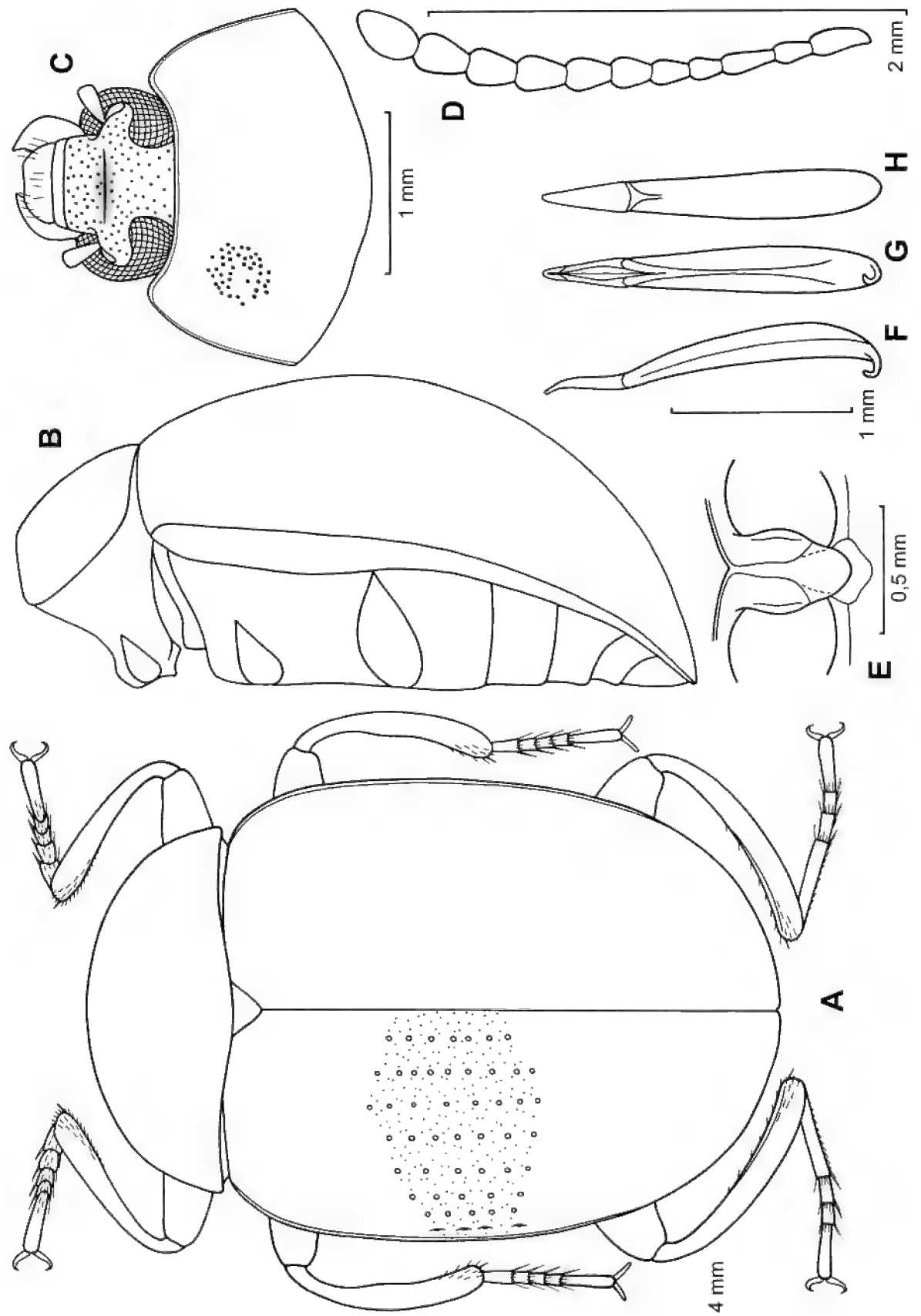


Fig. 22. *Amarygmus cyamias* n. sp. – **A** Habitus, ♂. **B** Body, lateral view. **C** Head and pronotum. **D** Antenna. **E** Prosternal apophysis. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

but *A. cyaneicollis* has a blue pronotum, is larger (body length 5.02–5.57 mm), and the punctures of the elytral intervals are less closely set.

Description

Measurements: Body length 4.36 mm; body width 2.80 mm. – Ratios: Pronotum: width/length 1.93; width hind corners/width front corners 1.70. Elytra: length/width 1.26; length elytra/length pronotum 3.14; maximum width elytra/maximum width pronotum 1.29.

Colouration: Upperside with strong lustre; ground colour green, but – according to the direction of light – reflecting violet, golden, or blue. Legs blackish brown. Antennae black. Underside dark brown to black, lustrous.

Head: Frons wide, twice as wide as length of antennomere 3, irregularly covered with small punctures. Genae slightly raised, anteriorly terminating in front of the middle part of the fronto-clypeal suture. Middle part of the fronto-clypeal suture straight, slightly incised. Clypeus stretched forwards, slightly convex transversely and longitudinally. Clypeus and frons with small punctures. Mentum reversely trapezoidal, with wide, flat lateral margins, space in between transversely convex, opaque. Underside of neck with closely set, medium-sized punctures. Mandibles on their outer surface with a sulcus, apically bifid.

Pronotum: Markedly convex transversely, slightly convex longitudinally. Lateral margins narrowing anteriorly, straight in the posterior three-fifths, bent in the anterior two-fifths. Anterior margin slightly excavated. Front corners rounded. Lateral margins continuously bordered, border of anterior margin weakened in its middle. Lateral borders in dorsal view narrowly visible. Front corners in lateral view rounded, slightly obtuse, hind corners angular, slightly obtuse. Surface with small, distinct and rather closely set punctures.

Scutellum: Triangular, with some minute punctures.

Elytra: Oval, markedly convex transversely and longitudinally. Maximum height and width in the middle. Shoulders slightly prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view only visible in the middle. With rows of small punctures; distance between punctures on disc in row 4 about 3–5 times diameter of a puncture; about 20 punctures in row 4. Intervals flat on the disc and laterally, with minute, widely separated punctures.

Prosternum: Anterior margin narrowly bent upwards, in its middle with a short keel. Apophysis half-elliptical, margins along procoxae only slightly widened, space in between with a deep groove.

Mesosternum: Hind part small, short; anterior margin deeply excavated.

Metasternum: Anterior margin between mesocoxae rounded, bordered. Borders behind mesocoxae with coarse punctures. Disc with minute, sparse punctures. Median line neither incised nor depressed.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, distinctly bordered; inner part of this border with medium-sized longitudinal punctures; margins behind metacoxae with coarse punctures. Sternites with widely separated, minute punctures. Sternite 5 apicomedially slightly depressed in male.

Antennae: Short, reaching to anterior fourth of elytra. Length/width ratio of antennomeres 1–11 equals to 11:6 / 5½:5 / 12:4½ / 7:5 / 8:5½ / 8:6 / 8:7½ / 9:8 / 10:8½ / 9:8½ / 14:8½.

Legs: Short. Femora thickened towards the second third. Protibiae slightly bent. Mesotibiae very strongly bent. Metatibiae somewhat less bent than mesotibiae. Protarsomeres 1–3 not widened in male. Lengths of protarsomeres 1–5 as 5:5:5:5:19, lengths of mesotarsomeres 1–5 as 7:6:4:4:19, lengths of metatarsomeres 1–4 as 23:9:6:19.

Aedeagus: See Fig. 22F–H.

Amarygmus cyaneicollis **n. sp.**
(Fig. 23A–E)

Holotype (♂): Borneo, Sabah, Tawau Hills Park, Tawau river, 8.VI.1998, leg. Kodada & Čiampor (SMNS).

Paratypes: Same data as holotype (1 ♀ SMNS, 1 ♀ ZSMB).

Etymology

Cyaneus (Lat.) = sea-blue; collis = elevation, in insects also pronotum.

Diagnosis

Small, oval, strongly convex. Elytra with rows of medium-sized, widely separated punctures; intervals of elytra flat, impunctate. Frons rather wide. Antennae of medium length, in males markedly longer than in females. Upperside lustrous, frons and pronotum sea-blue, elytra greenish blue. Underside bare in males.

A. cyaneicollis has a similarly wide frons as *A. cyamias* n. sp. On the differences between the two species see the diagnosis of *A. cyamias*.

Similar in size, shape and colour is also *A. splendidulus* (Fabricius, 1801) (redescribed and illustrated in Bremer 2005b: 52–54), but *A. splendidulus* has a markedly narrower frons than *A. cyaneicollis*, and the front corners of the pronotum are not pointed.

A. dryatidis Bremer, 2004 (Bremer 2004a: 44, fig. 27) from the Malayan Peninsula is also similar in length, shape and colour. However, the frons of *A. dryatidis* is narrower than in *A. cyaneicollis*, and the male metatibiae are abruptly bent in the middle.

Also *A. delicatulus* n. sp. from Sabah is similar in shape and size, but in this species the frons is markedly narrower than in *A. cyaneicollis*, the fronto-clypeal suture is deeper incised, and the elytra are more colourful.

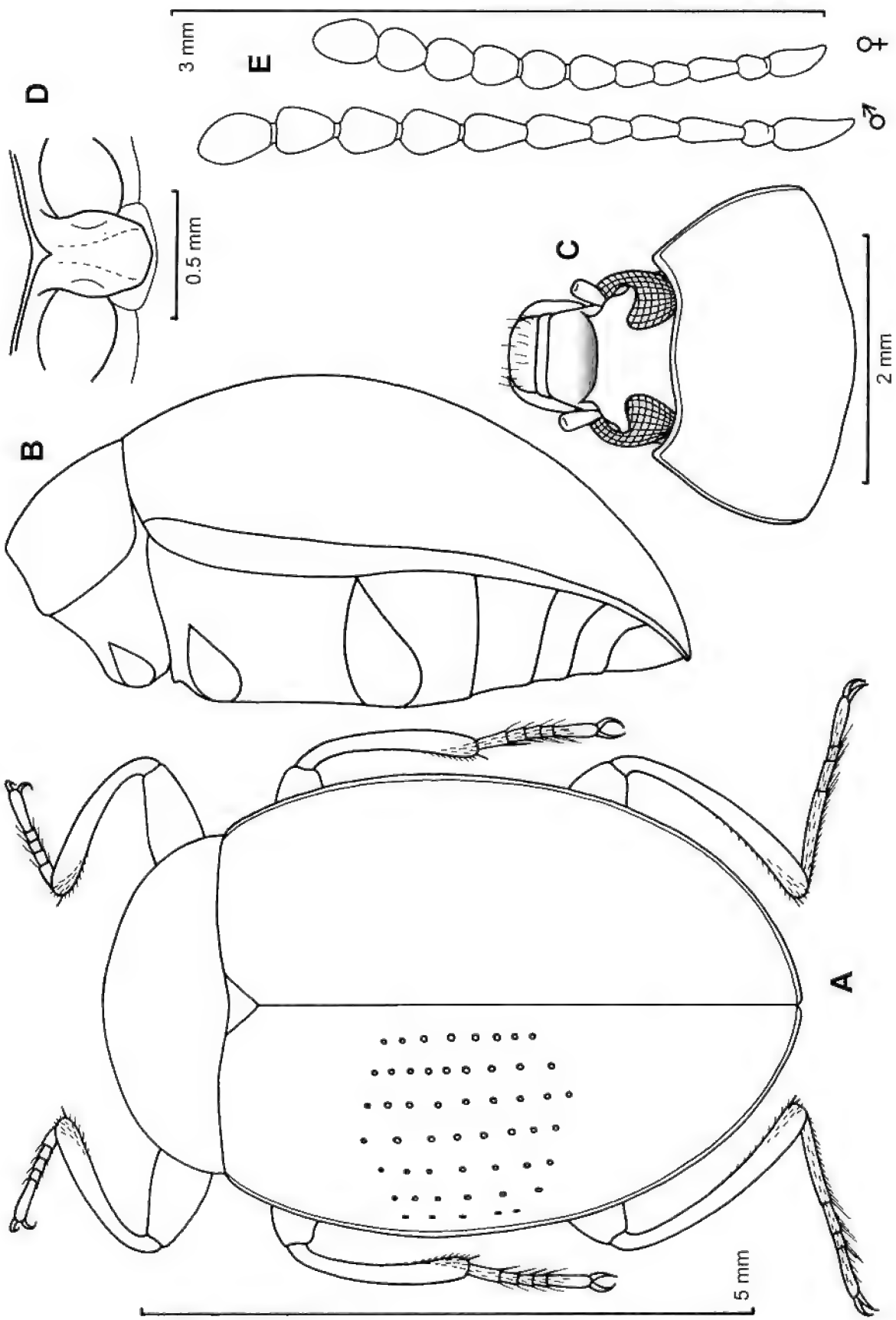


Fig. 23. *Amarygmus cyaneicollis* n. sp. – **A** Habitus, ♂. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antennae ♂ and ♀.

Description

Measurements: Body length 5.02–5.57 mm; body width 3.33–3.62 mm. – Ratios: Pronotum: width/length 1.94–2.05; width hind corners/width front corners 1.68–1.77. Elytra: length/width 1.20–1.25; length elytra/length pronotum 3.29–3.59; maximum width elytra/maximum width pronotum 1.37–1.44.

Colouration: Upperside lustrous. Head and pronotum sea-blue. Elytra greenish blue to coppery. Underside brown. Femora light brown, tibiae and tarsi brown. Antennomeres 1–5 brown, 6–11 black (antennomere 11 apically brightened).

Head: Frons of medium width, as wide as combined length of antennomeres 3+4. Genae somewhat raised, anteriorly terminating at the level of the middle part of the fronto-clypeal suture. Fronto-clypeal suture distinctly incised. Clypeus stretched forwards, slightly convex transversely and longitudinally. Clypeus and frons with widely separated, minute punctures; some clypeal punctures are origin of very short, tender hairs. Mentum reversely trapezoidal, sides slightly bent and with a rounded transition between sides and base; lustrous in its middle and somewhat convex transversely. Underside of neck with closely set, coarse punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Wide, short, markedly convex transversely, less convex longitudinally. Lateral margins narrowing anteriorly, bent in their hind part, more straight in their front part. Front corners pointed, acute-angled. Anterior margin slightly excavated. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view very narrowly visible. Front and hind corners in lateral view angular, front corners acute-angled, hind ones obtuse. Surface with very small, widely separated punctures.

Scutellum: Triangular, impunctate.

Elytra: Oval, short, markedly convex. Maximum height and width somewhat anterior to the middle. Shoulders rounded. Apices of elytra mutually rounded. Lateral edges in dorsal view very narrowly visible over their whole length. With rows of medium-sized punctures; distance between punctures on disc in row 4 about 3–4 times diameter of a puncture; about 19 punctures in row 4. Intervals flat, impunctate.

Prosternum: Anterior margin narrowly bent upwards, retracted towards apophysis in the middle, forming an obtuse angle. Apophysis oblong, oval, margins raised along coxae, space in between with a wide, deep groove; apophysis rounded apically, with a truncately raised keel in the middle.

Mesosternum: Hind part short, wide; anterior margin deeply excavated in its middle.

Metasternum: Anterior margin between mesocoxae rounded, bordered, behind this border with some medium-sized punctures. Disc somewhat convex, with a few very small punctures. Median line shallowly incised.

Sternites: Opaque. Anterior margin of sternite 1 between metacoxae widely ogival. Sternites impunctate.

Antennae: Of medium length, reaching to anterior third of elytra in males, markedly shorter in females. Length/width ratio of antennomeres 1–11 in male equals to 13:8 / 8:6 / 16:6 / 10:6 / 11:7 / 14:9 / 14:9 / 14:10 / 15:10 / 14:10 / 18:10, in female to 10:6½ / 7:5 / 10½:5 / 7:5½ / 8:6 / 10:8 / 11:9 / 11:9 / 12:9 / 11:9 / 15:9.

Legs: Short. Femora thickened towards the second third. Pro- and mesotibiae somewhat thickened anteriorly. Protibiae straight, meso- and metatibiae somewhat bent. Protarsomeres 1–3 not widened in males. Lengths of protarsomeres 1–5 as 4:4:4:4:20, lengths of mesotarsomeres 1–5 as 11:6:5:5:20, lengths of metatarsomeres 1–4 as 30:11:8:19.

Amarygmus cyclaeus **n. sp.**
(Fig. 24A–H)

Holotype (♀): Borneo, Sabah, S Keningau, 350 m, 20.–22.III.2007, leg. W. Schawaller (SMNS).

Paratypes: Borneo, Malaysia, Sabah, Keningau, 300 m, 20.–22.III.2007, R. Grimm (1 ♀ CG). – Borneo, Malaysia, Sabah, Keningau, 300 m, 6.–7.II.2006, R. Grimm (1 ♀ ZSMB). – Malaysia, Borneo, Sarawak, Kuching, Reservoir Park, 50 m, 4.–5.III.2008, R. Grimm (1 ♂ CG). – Same data as before, but 22.III.2008 (1 ♂ CG, 2 ♂♂ ZSMB). – Same data as before , but 21.–22.III.2009 (2 ♂♂ CG, 1 ♂ ZSMB). – Same data as before, but 8.IV.2009 (1 ♂ CG).

Circumstances of collection: On tree bark in parks, at night.

Etymology

Cyclaeus (Lat.) = bulgy.

Diagnosis

Small, with laterally clearly rounded elytra and a short, wide pronotum. Elytra with rows of small punctures, intervals flat and with minute punctures, upperside copper-coloured. Frons of medium width, eyes very large, fronto-clypeal suture situated just anterior to the eyes; antennae short, in males longer than in females. Pro- and mesotarsomeres 1–3 slightly widened in males, laterally with erect hairs.

The same size, the same colouration, and a similar structure of the elytra are present in *A. vilis* n. sp. from Sabah. However, *A. cyclaeus* has the elytra more convex laterally, the maximum width of the elytra anterior to the middle (at the anterior third in *A. vilis*), the frons somewhat wider, the fronto-clypeal suture situated just anterior to the eyes (in *A. vilis* in some distance to the eyes), and the metatibiae more strongly bent.

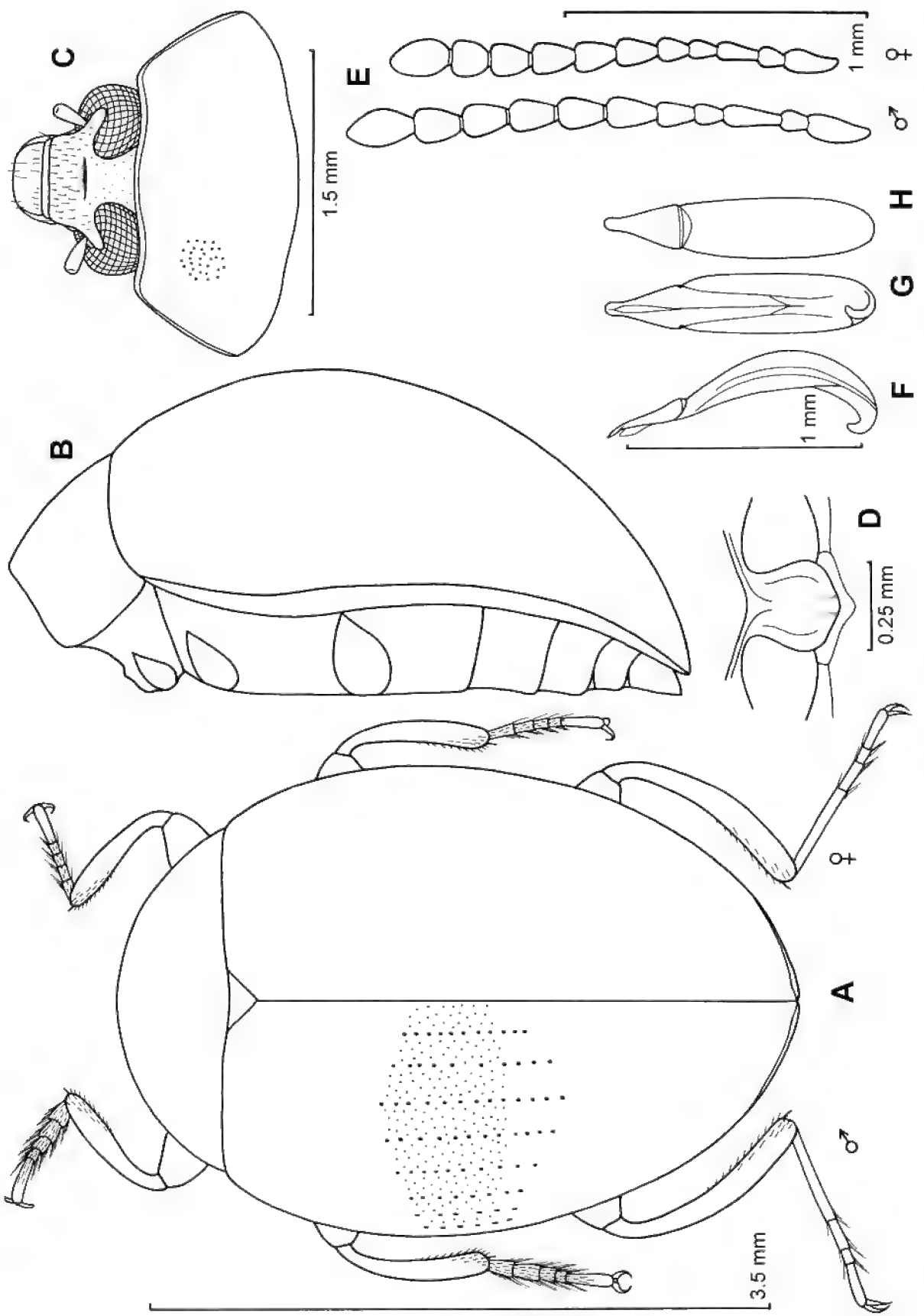


Fig. 24. *Amarygmus cyclaeus* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antennae ♂ and ♀. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

Description

Measurements: Body length 3.66–4.05 mm; body width 2.33–2.61 mm. – Ratios: Pronotum: width/length 2.13–2.33; width hind corners/width front corners 1.67–1.72. Elytra: length/width 1.25–1.33; length elytra/length pronotum 3.48–3.69; maximum width elytra/maximum width pronotum 1.24–1.37.

Colouration: Upperside coppery, lustrous. Legs brown. Antennomeres 1–5 light brown, 6–11 black (antennomere 11 apically brightened). Underside brown, lustrous.

Head: Frons of medium width, approximately as wide as combined length of antennomeres 3+4, descending to fronto-clypeal suture. Genae narrow, slightly raised, anterolaterally enclosed by the large eyes, anteriorly terminating just in front of the middle part of the fronto-clypeal suture. Fronto-clypeal suture widely and markedly depressed, slightly incised in its middle part, scarcely incised in its lateral parts, the middle part situated just in front of the eyes. Clypeus stretched forwards, convex longitudinally, with small hairs. Clypeus and frons with small, not very closely set punctures. Mentum reversely trapezoidal, lateral margins wide, lustrous, flat, space in between transversely convex. Underside of neck with some small punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Wide, short, markedly and uniformly convex transversely, only slightly convex longitudinally. Lateral margins narrowing anteriorly, bent. Front corners rounded; hind corners angular, obtuse. Anterior margin somewhat excavated. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view visible over their whole length. Front and hind corners in lateral view obtuse. Surface with small, shallow, not very closely set punctures.

Scutellum: Triangular, with some minute punctures.

Elytra: Short, strongly convex longitudinally and transversely, lateral surface bulgy. Maximum width and height just anterior to the middle. Shoulders indistinct. Apices of elytra mutually rounded. Lateral edges in dorsal view narrowly visible only in the hind third. With rows of small punctures; distance between punctures on disc in row 4 about 2 times diameter of a puncture; about 30 punctures in row 4. Intervals flat, with minute, not very closely set punctures.

Prosternum: Anterior margin narrowly bent upwards, in its middle with a short triangular process towards apophysis. Apophysis wide, flat, drop-shaped, with the maximum width behind coxae.

Mesosternum: Hind part short, wide, slightly grooved laterally; anterior margin widely excavated in the middle.

Metasternum: Anterior margin between mesocoxae rounded, broadly bordered. Disc anteriorly with some shallow, small punctures, posteriorly impunctate. Median line neither depressed nor incised.

Sternites: Anterior margin of sternite 1 between metacoxae widely ogival, faintly bordered. Sternites with a few very widely separated, minute punctures. Sternite 5 apicomedially strongly depressed in males.

Antennae: Short, reaching over base of elytra by about 1–2 antennomeres. Length/width ratio of antennomeres 1–11 in female equals to 10:4 / 5:3½ / 7:3 / 3½:3½ / 4½:4 / 5:5 / 6:5 / 6:5 / 6:5 / 6:5½ / 9:6, in male to 10:4 / 5:3½ / 9:3½ / 5:4 / 6:4½ / 7:5 / 8:5 / 8:5½ / 8:5½ / 8:5½ / 11:6.

Legs: Short. Femora thickened towards the second third. Protibiae slightly bent basally, straight anteriorly; meso- and metatibiae bent. Lengths of protarsomeres 1–5 in male as 4:3:3:3:12, lengths of mesotarsomeres 1–5 as 8:4:3:3:12, lengths of metatarsomeres 1–4 as 26:8:4:12.

Aedeagus: See Fig. 24F–H.

Amarygmus delicatulus **n. sp.**
(Fig. 25A–E)

Holotype (♀): Keningau, Sabah, N Borneo, 25.V.1989, M. Itoh (CA).

Paratype: Same data as holotype, but 27.V.1989 (1 sex not determined ZSMB).

Etymology

Delicatulus (Lat.), comparative of delicatus.

Diagnosis

Small, oval. Elytra markedly convex, with rows of very small, round, widely separated punctures. Fronto-clypeal suture very deeply incised, groove-like, frons rather narrow, antennae not very long. Metatarsomere 1 very long. Elytra very lustrous, iridescent colours blue, green, golden, and violet.

The common *A. splendidulus* (Fabricius, 1801) (redescribed in Bremer 2005b: 52–54) is very similar to *A. delicatulus* in shape, colouration, and width of frons, but the fronto-clypeal suture of *A. splendidulus* is less incised, and the punctures of the elytral rows are larger and closer set.

A. diversetinctus Pic, 1925 from Java (redescribed in Bremer 2004a: 22) is similar to *A. delicatulus* in shape, colouration, the groove-like fronto-clypeal suture, and the small punctures of the elytral rows. However, in *A. diversetinctus* the elytra and the distance between the punctures of the elytral rows are narrower, and the frons is wider.

A. voluptabilis Bremer, 2006 from Sabah (Bremer 2006a: 30–33) also resembles *A. delicatulus*. In *A. voluptabilis* the punctures of the elytral rows are oblong (round in *A. delicatulus*) and the frons is wider.

For differences to *A. cyaneicollis* n. sp. see diagnosis of this species.

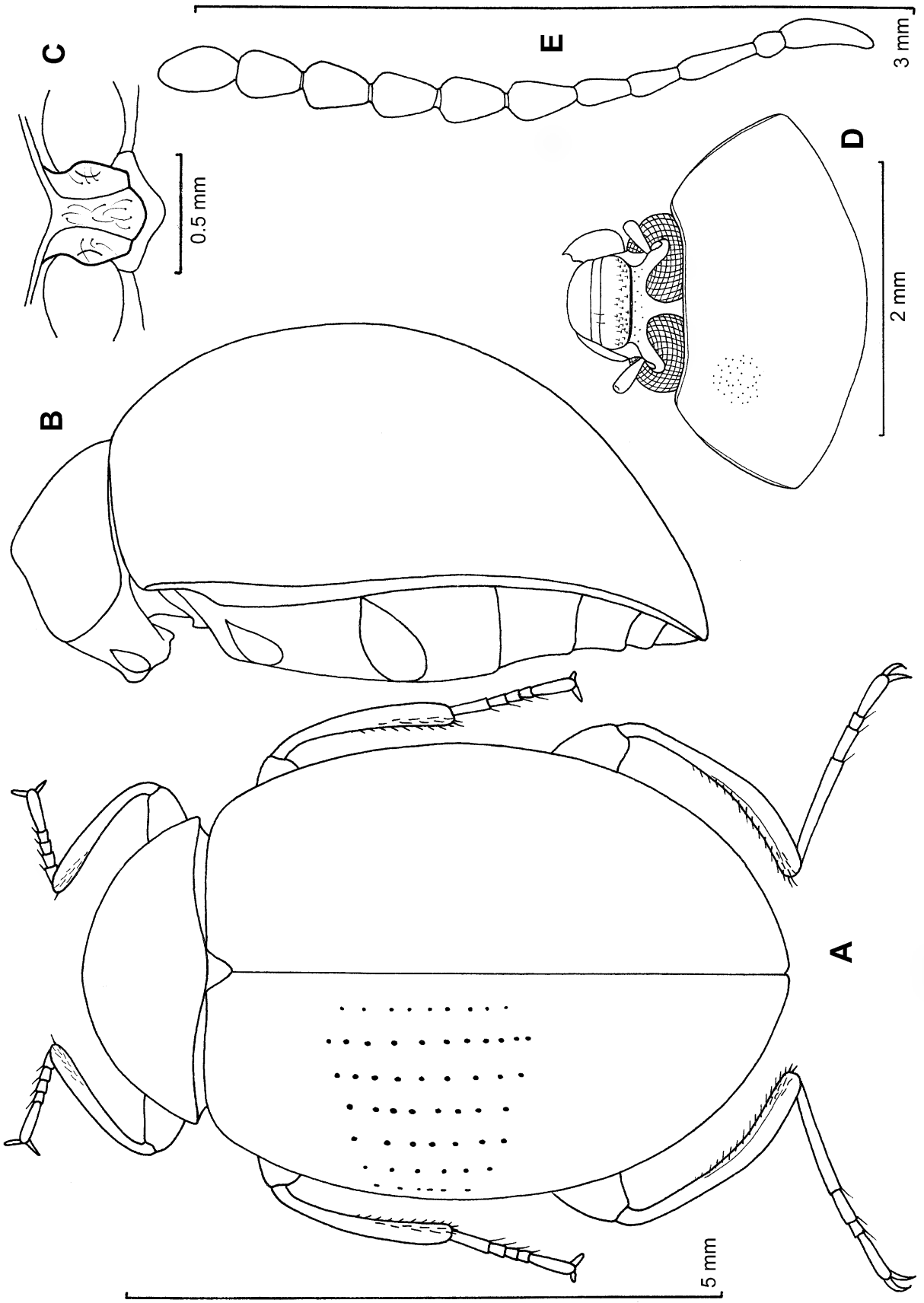


Fig. 25. *Amarygmus delicatulus* n. sp. – **A** Habitus. **B** Body, lateral view. **C** Prosternal apophysis. **D** Head and pronotum. **E** Antenna.

Description

Measurements: Body length 5.49+5.65 mm; body width 3.60+3.80 mm. – Ratios: Pronotum: width/length 2.17+2.24; width hind corners/width front corners 1.78+1.83. Elytra: length/width 1.26+1.30; length elytra/length pronotum 4.06+4.07; maximum width elytra/maximum width pronotum 1.40+1.45.

Colouration: Upperside brilliant. Frons and pronotum blue. Clypeus brown. Elytra bluish green (in oblique view from the front the shoulders and partially the front part of the elytra reflect violet or golden). Legs and antennae brown. Underside brown.

Head: Frons narrow, its width equivalent to the length of antennomere 2. Genae narrow, slightly raised. Fronto-clypeal suture deeply incised in its whole width. Clypeus rather short, longitudinally clearly convex, transversely less convex, with small, not very closely set punctures; punctures on frons more widely separated and smaller than those on clypeus. Mentum reversely trapezoidal, lateral margins broad, flat, lustrous; space in between opaque, moderately convex transversely. Mandibles on their outer surface with a sulcus, apically bifid.

Pronotum: Wide, not very strongly convex transversely, slightly convex longitudinally. Lateral margins narrowing anteriorly, bent. Anterior margin slightly excavated. Lateral and anterior margins continuously bordered; front corners and borders behind the front corners not visible in dorsal view. Front corners in lateral view rounded, hind corners more angular and more obtuse-angled than front corners. Surface with tiny, widely separated punctures.

Scutellum: Triangular, impunctate.

Elytra: Oval, rather short, markedly convex transversely and longitudinally. Maximum height and width in the middle. Shoulders rounded. Apices of elytra mutually rounded. Lateral edges in dorsal view visible only posteriorly. With rows of small, very widely separated punctures; distance between punctures on disc 3–4 times diameter of a puncture; about 18–20 punctures in row 4. Intervals flat, with tiny, widely separated punctures (visible at 50-fold magnification).

Prosternum: Anterior margin narrowly bent upwards laterally; a relatively wide, low keel emerging from the middle of the anterior margin, extending across the whole apophysis. Lateral margins of apophysis somewhat widened and raised along coxae, space in between like a wide, shallow trough; margins behind coxae narrowing. Apophysis widely rounded apically, with irregularly set, moderately long, erect, tender hairs.

Mesosternum: Hind part short, wide; anterior margin widely but not deeply excavated in the middle, posterior to this excavation with a slightly depressed, smooth area; with some moderately long hairs laterally.

Metasternum: Slightly opaque. Anterior margin between mesocoxae widely rounded, with a thick border. Anterior part of disc with indistinct, medium-sized, not very closely set punctures; posterior part with minute punctures and short, semi-erect hairs which originate from these punctures. Median line very slightly incised.

Sternites: Opaque, strongly microreticulated. Anterior margin of sternite 1 between metacoxae widely ogival, with a thick border. Sternites 1 and 2 with some faint wrinkles, sternites 3–5 with a few tiny punctures.

Antennae: Short, reaching to anterior fourth of elytra. Length/width ratio of antennomeres 1–11 equals to 16:6 / 6:5½ / 14:5 / 11:5 / 11:5½ / 13:8 / 14:8½ / 15:9 / 14:9 / 13:9 / 17:9.

Legs: Short. Femora thickened towards the second third. Protibiae straight; mesotibiae slightly bent; metatibiae distinctly bent. Lengths of protarsomeres 1–5 as 4:4:4:4:19, lengths of mesotarsomeres 1–5 as 14:8:5:4:19, lengths of metatarsomeres 1–4 as 39:15:5:18.

Amarygmus disgregatus **n. sp.**
(Fig. 26A–I)

Holotype (♂): Borneo, Sabah, Mt. Kinab[alu] NP, Por[ing], H. S. Area, Eastern Ridge Tr[ail], 790 m, 16.VIII. [19]88, A. Smetana (B116) (MHNG).

Paratypes: Borneo, Sarawak, Bako NP, 5.V.2000, M. Vyklický leg. (1 ♂ SSB, 1 ♀ ZSMB). – Malaysia, Borneo, Sarawak, Kubah NP, 250 m, 6.–8.III.2008, R. Grimm (1 ♂ CG, 1 ♂ ZSMB, 1 ♀ CG). – Borneo, Malaysia, Sarawak, Kubah NP nr. HQ, 100–300 m, 15.–18.IX.2008, R. Grimm (1 ♀ CG). – Borneo, Malaysia, Sarawak, Kubah NP, HQ vic., 100–300 m, 27.–28.III.2009, R. Grimm (1 ♂ ZSMB, 1 ♀ CG). – Malaysia, Borneo, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 20–150 m, 13.–15.III.2008, R. Grimm (1 ♂ CG). – Borneo, Malaysia, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 10–200 m, 11.–14.IX.2008, R. Grimm (1 ♀ CG). – Same data as before, but 4.–8.IV.2009 (1 ♀ CG). – Malaysia, Borneo, Sarawak, NW Kuching, Matang Wildlife Centre, 50–100 m, 16.–17.III.2008, R. Grimm (1 ♀ CG, 1 ♀ ZSMB). – Borneo, Malaysia, Sarawak, Gunung Gading NP, 100–300 m, 23.–29.IX.2008, R. Grimm (2 ♀♀ CG). – Same data as before, but 31.III.–4.IV.2009 (2 ♂♂, 2 ♀♀ CG; 1 ♀ ZSMB).

Circumstances of collection: On tree bark in lowland primary forest, at night.

Etymology

Disgregatus (Lat.) = separated.

Diagnosis

Small, oval. Males with long, closely set hairs on front of profemora, back of mesofemora, prosternal apophysis, and mesosternum. Hind corners of pronotum widely rounded. Elytra with incised striae with large punctures; intervals convex. Pronotum and lateral parts of elytra blue or violet, disc of elytra coppery, femora and tibiae black [a differently coloured variety (from Sarawak, Kubah NP, 6.–8.III.2008) has a dark violet pronotum, dark violet elytral sides, yellowish brown femora and black tibiae].

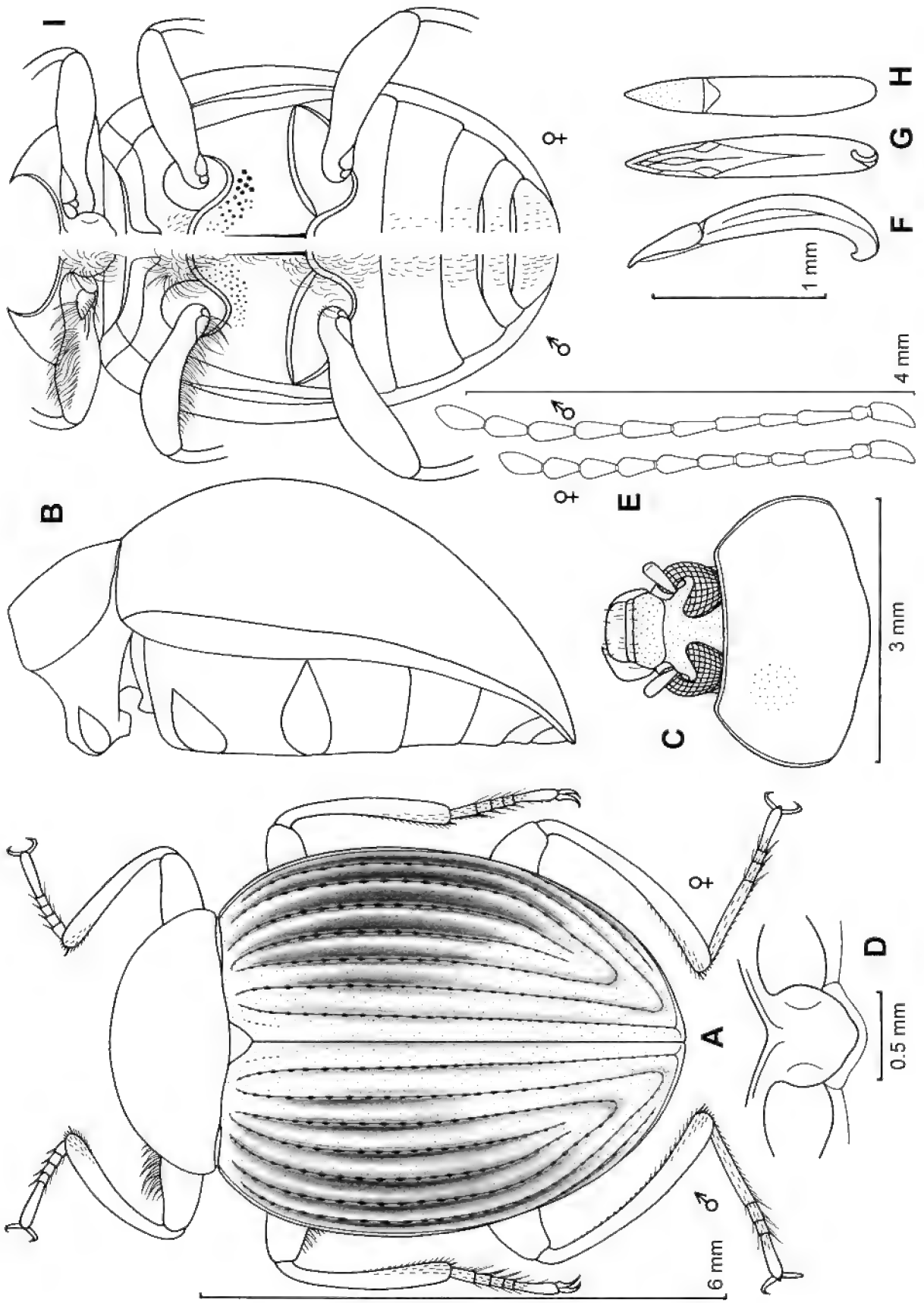


Fig. 26. *Amarygmus disgregatus* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis, ♀. **E** Antennae ♂ and ♀. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view. **I** Body, ventral view; left side ♂, right side ♀.

Because of the male sexual characters and the shape of the body *A. disgregatus* belongs to a species group near *A. postdepressus* Pic, 1938 (redescribed in Bremer 2004a: 29–31, fig. 16). The widely rounded hind corners of the pronotum especially resemble *A. crockeri* Bremer, 2004 (Bremer 2004e: 111–113) and *A. novior* n. sp.

A. crockeri is larger than *A. disgregatus* (body length 7.01–7.64 mm), the upperside is uniformly copper-coloured, and the elytra are longer.

A. novior has about the same size and shape as *A. disgregatus*, but *A. novior* neither shows a blue or violet pronotum nor blue or violet shoulders of the elytra, and the frons is somewhat wider.

A. postdepressus is usually larger than *A. disgregatus*, but the colouration of the upperside is uniformly black or copper-coloured (and with a markedly stronger lustre than in *A. disgregatus*), and the hind corners of the pronotum of are either angled or only very weakly rounded.

Description

Measurements: Body length 6.05–7.01 mm; body width 3.38–4.50 mm. – Ratios: Pronotum: width/length 1.86–2.03; maximum width hind corners/width front corners 1.75–1.93. Elytra: length/width 1.22–1.29; length elytra/length pronotum 3.24–3.63; maximum width elytra/maximum width pronotum 1.41–1.51.

Colouration: Pronotum and frons blue, violet or green, lustrous; clypeus black. Lateral parts of elytra including shoulders blue or violet, disc copper-coloured. Prosternum and mesosternum brown, metasternum and sternites black. Femora and tibiae black, tarsi brown. Antennomeres 1–6 brown, 7–11 black (antennomere 11 apically brightened). Hairs light. For colour variety see diagnosis.

Head: Upperside slightly opaque. Frons of medium width, markedly narrower than length of antennomere 4 (like 14 : 19). Genae short, anteriorly terminating behind the middle part of the fronto-clypeal suture. Fronto-clypeal suture straight, slightly incised in its middle part, not incised laterally. Clypeus stretched forwards, slightly convex longitudinally, lateral margins slightly bent; with very small, widely separated punctures and very short hairs originating from these punctures. Punctures of frons smaller and more widely separated than those of clypeus. Mentum reversely trapezoidal, with wide, flat, lustrous lateral margins, space in between transversely convex, less lustrous than lateral margins. Underside of neck with medium-sized, closely set punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Wide, convex transversely, less convex longitudinally. Maximum width somewhat behind the middle. Margins narrowing and bent towards the widely rounded hind corners, less convergent towards the front corners. Anterior margin slightly excavated. Front corners in dorsal view rounded. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view narrowly visible over their whole length. Front corners in lateral view slightly angular, obtuse; hind corners widely rounded and more obtuse than front corners. Surface with very small, widely separated punctures.

Scutellum: Triangular, with a few tiny punctures.

Elytra: Widely oval, short, convex transversely and longitudinally. Maximum width and height anterior to the middle, posteriorly gently descending towards apex. Lateral margins convergent towards shoulders. Apices of elytra mutually rounded. Lateral edges in dorsal view visible over their whole length. With distinctly incised striae with large punctures which are slightly wider than a stria; distance between punctures on disc in row 4 equal to the diameter of a puncture; about 22 punctures in stria 4. Intervals convex on disc, with tiny, widely separated punctures.

Prosternum: Anterior margin continuously and narrowly bent upwards, retracted towards apophysis and acute-angled in its middle. Apophysis wide, laterally rounded, margins along coxae somewhat bent upwards, space in between slightly depressed; in females apophysis with some hairs of medium length, in males with long, erect, very dense hairs which cover the entire apophysis.

Mesosternum: Hind part very short, wide; anterior margin shallowly excavated in its middle; in females with some hairs of medium length, in males with long, dense erect hairs like on the prosternal apophysis.

Metasternum: Anterior half of disc with closely set punctures of medium size, posterior half with very small punctures; a few very short (females) or long (males) hairs are originating from these punctures. Median line slightly depressed in its posterior part.

Sternites: Anterior margin of sternite 1 between metacoxae widely ogival, with a thick border. Sternites nearly impunctate, in females with tiny hairs, in males with some hairs of medium length. Sternite 5 apicomedially neither depressed nor excavated, with some nearly recumbent hairs of medium length.

Antennae: Rather long, reaching to about middle of elytra in males, somewhat shorter in females. Length/width ratio of antennomeres 1–11 in male equals to 21:9 / 9:7 / 24:6 / 19:6½ / 20:7 / 18:7 / 20:9½ / 21:9½ / 19:9½ / 17:9½ / 22:10, in female to 20:7½ / 9:6½ / 20:6 / 15:6 / 17:6 / 15:6 / 18:8½ / 17:9 / 16:9½ / 16:9½ / 21:10.

Legs: Short. Femora thickened towards the second third; front of profemora and back of mesofemora in the basal two-thirds with very dense, long hairs in males; in females without hairs. Protibiae somewhat bent; mesotibiae less bent than protibiae; metatibiae rather long, markedly bent, in males on inner side with small tubercles in the basal half, somewhat widened in the apical half, females without these modifications. Protarsomeres 1–3

not widened in males. Lengths of protarsomeres 1–5 as 6:6:6:6:26, lengths of mesotarsomeres 1–5 as 13:9:7:6:26, lengths of metatarsomeres 1–4 as 36:12:8:26.

Aedeagus: See Fig. 26G–I.

Amarygmus emasensis **n. sp.**
(Fig. 27A–H)

Holotype (♂): Malaysia, Sabah, Gunung Emas, 15.–17.IV.1993, M. Štrba, J. Jeniš leg. (ZSMB).

Circumstances of collection: Mountainous primary forest (no further information).

Etymology

Emasensis, derived from the collection site of the holotype "Gunung Emas".

Diagnosis

Large, oblong, relatively narrow. Elytra long, lateral margins nearly straight from shoulders to posterior third, with superficial striae with slight rhombic widenings, intervals flat. Frons narrow; antennae short. Upperside brown, slightly lustrous.

Amarygmus emasensis n. sp. belongs to a group of species which formerly was assigned to the genus *Elixota*. Within this group, it shows some similarity to *A. blanchardi* Bremer, 2001, *A. muluensis* n. sp., and in particular to *A. macer* (Gebien, 1927) from Sabah. *A. macer*, which probably occurs at lower altitudes than *A. emasensis*, differs from *A. emasensis* in the wider frons, the rows of slightly elongate punctures on the elytra, and the shorter antenna.

Striae with rhombic widenings are also found in *A. hassalti* Fairmaire, 1882 from Borneo and in *A. muluensis* from Sarawak. *A. hassalti* has (although oblong) a more voluminous body than *A. emasensis*, its frons is slightly wider, the males have a swelling on the inner side of the mesotibiae, and the male mesotibiae are markedly bent on the outer side. The elytra of *A. muluensis* are shorter than in *A. emasensis* (elytral length/width 1.55 : 1), the punctures of the elytral striae are larger than the puncture equivalents of *A. emasensis*, the antennae are shorter, and the frons is wider.

Description

Measurements: Body length 10.11 mm; body width 4.22 mm. – Ratios: Pronotum: width/length 1.77; width hind corners/width front corners 1.74. Elytra: length/width 1.81; length elytra/length pronotum 3.69; maximum width elytra/maximum width pronotum 1.15.

Colouration: Upperside brown, slightly lustrous. Femora brown, tibiae dark brown, tarsi brown. Antennomeres 1–3 brown, 4–11 black (apical third of antennomere 11 yellowish brightened).

Head: Frons relatively narrow, nearly as wide as length of antennomere 2. Eyes very large. Genae slightly raised, anteriorly terminating in front of the middle part of the fronto-clypeal suture. Fronto-clypeal suture depressed, slightly incised, situated just in front of the eyes. Clypeus short. Clypeus and frons with minute, relatively closely set punctures. Mentum reversely trapezoidal, lateral margins wide, flat, lustrous, middle part in between opaque and convex transversely. Underside of neck with small, closely set punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Narrow, markedly convex transversely, slightly convex longitudinally. Widest at base, narrowing towards front corners and bent. Front corners not projecting, hind corners angular and clearly obtuse. Anterior margin slightly excavated. Lateral and anterior margins continuously bordered, lateral borders narrowly visible in dorsal view. Front and hind corners in lateral view slightly obtuse and angular. Surface with minute, irregularly set punctures.

Scutellum: Triangular, impunctate.

Elytra: Oblong, strongly convex transversely, less convex longitudinally, nearly straight margins between shoulders and the posterior third. Maximum height approximately in the middle. Shoulders rounded. Apices of elytra mutually rounded. Lateral edges in dorsal view narrowly visible in the anterior two-thirds. With faint, scarcely incised striae with small rhombic widenings similar to punctures; distance between widenings in stria 4 equal to the diameter of a widening. Intervals flat, with tiny, widely separated punctures.

Prosternum: Anterior margin continuously bent upwards, somewhat retracted towards apophysis in the middle. Apophysis narrow, rising ventrad between anterior margin and area along procoxae, margins widened and markedly raised along coxae, median space in between with a deep, narrow groove; apophysis descending posteriorly behind coxae, margins behind coxae straight and somewhat narrowing; apophysis broadly pointed apically.

Mesosternum: Hind part narrow; lateral margins somewhat raised; anterior margin excavated in the middle.

Metasternum: Anterior margin between mesocoxae narrowly rounded, broadly bordered. Metasternum anteriorly with 2–3 rows of medium-sized punctures, posteriorly with tiny, sparse punctures. Median line markedly depressed on its whole length and somewhat incised.

Sternites: Anterior margin of sternite 1 between metacoxae narrowly ogival, indistinctly bordered. Discs of sternites with tiny, widely separated punctures. Sternite 5 apicomedially markedly depressed.

Antennae: Short, reaching to anterior third of elytra. Antennomere 11 asymmetrically rounded apically. Length/width ratio of antennomeres 1–11 equals to 15:8½ / 10:8 / 16:7½ / 13:9 / 14:11½ / 15:13 / 15:13 / 17:13 / 16½:13 / 18:13 / 24:13.

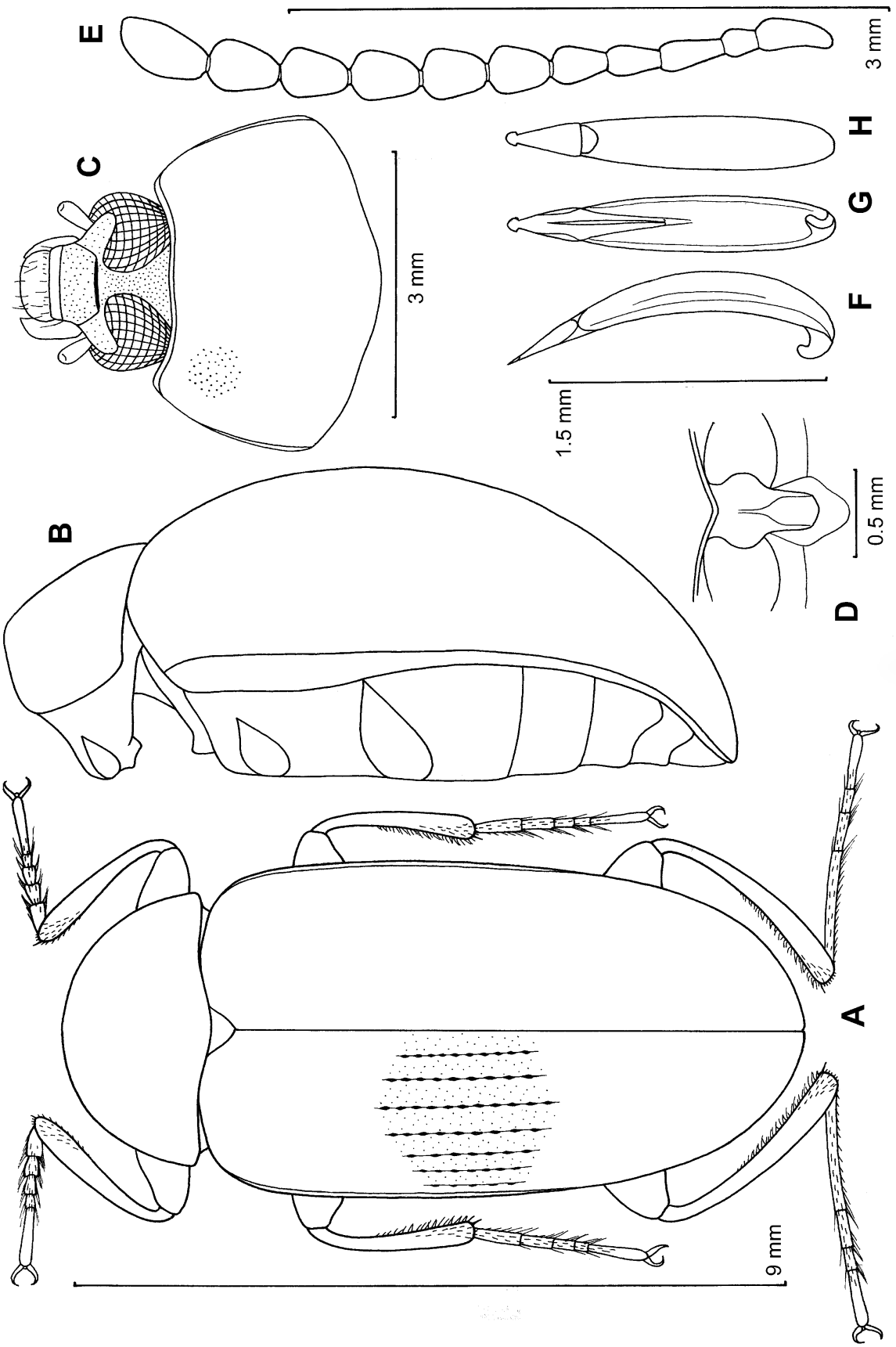


Fig. 27. *Amarygmus emasensis* n. sp. – **A** Habitus, ♂. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

Legs: Short. Femora markedly thickened towards their second third. Pro- and mesotibiae slightly bent; protibiae on inner side in apical fifth with short semi-erect hairs, mesotibiae on inner side in apical half with semi-erect hairs of medium length. Metatibiae somewhat more bent than pro- and mesotibiae. Protarsomeres 1–3 slightly widened, with brush-like soles. Lengths of protarsomeres 1–5 as 12:11:12:9:36, lengths of mesotarsomeres 1–5 as 29:19:14:8:36, lengths of metatarsomeres 1–4 as 66:25:16:36.

Aedeagus: See Fig. 27F–H.

Amarygmus erilis **n. sp.**
(Fig. 28A–E)

Holotype (♀): Indonesia, 7.–22.IX.1997, South Kalimantan, Loksado, 1000 m, S. JÁKL leg. (SSB).

Etymology

Erilis (Lat.) = children of a household.

Diagnosis

Small, oblong, oval, strongly convex transversely and longitudinally, elytral iridescence with all colours of the spectrum. Elytra with slightly incised striae with relatively large, rhombic punctures; intervals flat on disc, slightly convex laterally, with very small, distinct punctures. Frons rather narrow, antennae long.

A similar species is *A. eureos* n. sp. (see below) from Borneo. *A. eureos* shows a nearly identical shape and a similar colouration, but has rows of large punctures instead of striae and the punctures separated by a wider distance. Also *A. inconditus* n. sp. shows some similarities (see diagnosis of this species).

Description

Measurements: Body length 5.47 mm; body width 3.27 mm. – Ratios: Pronotum: width/length 2.00; width hind corners/width front corners 1.74. Elytra: length/width 1.43; length elytra/length pronotum 3.65; maximum width elytra/maximum width pronotum 1.27.

Colouration: Ground colour green, slightly lustrous. Upperside slightly microreticulated. Pronotum somewhat brighter than elytra; if light hits the pronotum in direction from the front there are no colourful reflections. Elytra – in contrast to the pronotum – with an intensive iridescence showing all colours of the spectrum. Tibiae black, tarsi dark brown. Antennomeres 1–7 brown, 8 dark brown, 9–11 black. Underside black.

Head: Frons very narrow, slightly convex longitudinally, approximately as wide as the diameter of antennomere 3. Genae very narrow, short, very slightly raised, anteriorly terminating behind the level of the middle part of the fronto-clypeal suture. Fronto-clypeal suture slightly incised in the middle, situated very near anterior to the edge of the eyes. Clypeus stretched forwards, slightly convex transversely, with small, rather closely set punctures; punctures of frons smaller and more widely separated. Mentum reversely trapezoidal. Underside of neck very narrowly grooved transversely, with large, superficial, not very closely set punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Somewhat convex transversely and longitudinally. Lateral margins narrowing anteriorly, in the posterior half with straight margins, in the anterior part rounded. Anterior margin very slightly excavated. Lateral and anterior margins continuously and narrowly bordered. Lateral borders in dorsal view narrowly visible, except a small part behind front corners. Front and hind corners in lateral view rounded, slightly obtuse. Surface with small, irregularly and not very narrowly set punctures.

Scutellum: Triangular, sides slightly bent, with minute punctures.

Elytra: Elongate oval, markedly convex transversely, less convex longitudinally. Maximum width and height somewhat anterior to the middle. Shoulders slightly rounded. Apices of elytra mutually rounded. Lateral edges in dorsal view very narrowly visible posterior to the middle. With slightly incised striae with large, rhombic, widely separated punctures; distance between punctures on disc in stria 4 about 2–3 times diameter of a puncture; about 20 punctures in stria 4. Intervals flat on disc, moderately convex laterally, with minute, distinct punctures.

Prosternum: Anterior margin narrowly bent upwards; retracted towards apophysis in its middle, forming an obtuse angle; a narrow keel originating from the middle of the anterior margin. Lateral margins along procoxae widened and raised, space in between forming a rather wide and deep groove. Apophysis behind coxae stretched posteriorly, with straight, subparallel sides, obtusely pointed apically.

Mesosternum: Short. Anterior margin somewhat excavated in its middle; lateral margins with a rough surface, convergent posteriorly.

Metasternum: Lustrous. Anterior margin between mesocoxae rounded, bordered. Apophysis behind the anterior border raised like a hunch. Disc microreticulated, with tiny, widely separated punctures. Median line widely and deeply depressed on its whole length.

Sternites: Opaque. Sternites 1 and 2 with widely separated punctures.

Antennae: Long, antennae reaching to about middle of elytra. Length/width ratio of antennomeres 1–11 equals to 17:6 / 8:5½ / 19:5 / 12:5 / 13:5½ / 13:6½ / 14:6½ / 14:7 / 14:7 / 14:7 / 17:7½.

Legs: Short. Femora thickened towards the second third. Tibiae somewhat thickened apically; protibiae

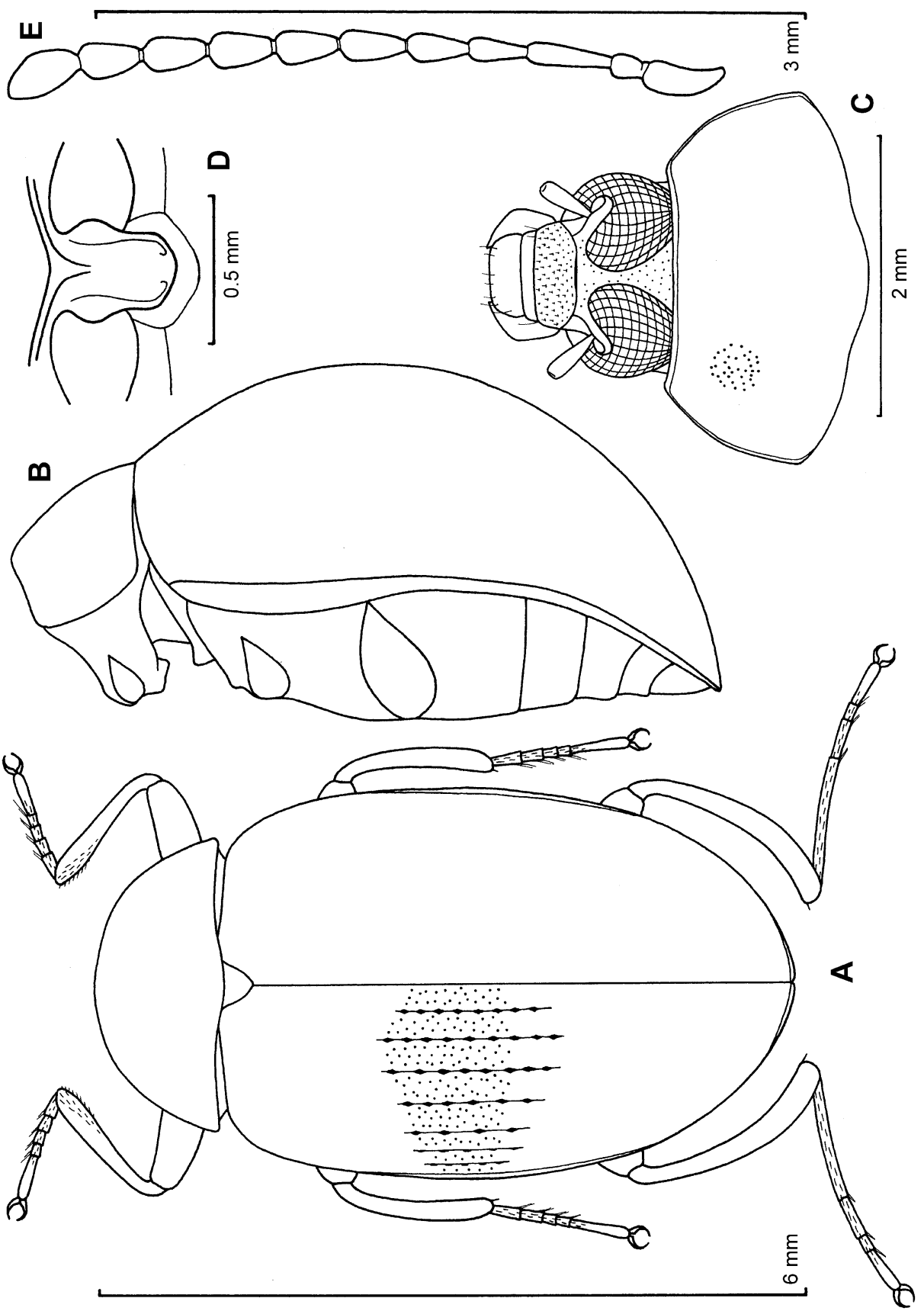


Fig. 28. *Amarygmus erilis* n. sp. – **A** Habitus, ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna.

straight; mesotibiae moderately bent; metatibiae slightly bent in the basal half, more strongly bent in the apical half. Lengths of protarsomeres 1–5 as 8:6:6:5:20, lengths of mesotarsomeres 1–5 as 12:8:7:5:21, lengths of metatarsomeres 1–4 as 44:15:7:20.

Amarygmus eureos **n. sp.**
(Fig. 29A–H)

Holotype (♂): Borneo, Malaysia, Sabah, Kinabalu NP, Poring vic., 380 m, 9.–11.III.2007, R. Grimm (CG).

Paratypes: Borneo, Sabah, Crocker Range W, Route Keningau–Papar, II.2000, M. Snižek leg. (1 ♀ ZSMB). – Keningau, Sabah, N Borneo, 25.V.1989, M. Itoh (1 ♀ CA).

Circumstances of collection: Lowland primary forest, on the bark of a tree, at night (holotype).

Etymology

Eureos, name of a precious stone (mentioned by Plinius senior in his "Naturalis historia"). It is unknown which precious stone was meant.

Diagnosis

Small, slightly oblong. Pronotum narrower than elytra, clearly descending in respect to elytra. Colouration variable. Elytra markedly convex transversely and longitudinally, with rows of closely set large punctures. Frons narrow. Male pro- and mesotarsomeres 1–3 widened. Aedeagus with a small barbed hook dorsally at the tip.

A. inconditus n. sp. has a similar size and shape as *A. eureos*, the frons is similarly narrow, and the males of both species possess widened pro- and mesotarsomeres and a barbed hook on the aedeagus. However, the punctures of the elytral rows of *A. inconditus* have a blue colour, and the punctures of the elytral intervals are large and closely set, causing an opaque surface.

A. erilis shows the same shape and size and similar colour and iridescence as *A. eureos*, but the punctures of the elytral rows of *A. erilis* are smaller, rhombic and linked by faint lines.

A. tenellus Bremer, 2003 (Bremer 2003b: 60–61) from Borneo and *A. fulgurans* Gebien, 1927 (redescribed in Bremer 2003b: 55–56) from Sumatra and Java, probably belong to the same group of species as *A. eureos*. *A. fulgurans* also has the small barbed hook at the top of the aedeagus (no males are known from *A. tenellus*).

Also *A. steatitis* Bremer, 2005 (Bremer 2005a: 20–21, only females known) from the Malayan Peninsula shows size, punctation and iridescence similar to *A. eureos*, but it has a wider frons.

Description

Measurements: Body length 5.49–5.85 mm; body width 3.30–3.42 mm. – Ratios: Pronotum: width/length 1.94–2.03; width hind corners/width front corners 1.63–1.73. Elytra: length/width 1.47–1.48; length elytra/length pronotum 3.71–3.97; maximum width elytra/maximum width pronotum 1.30–1.32.

Colouration: Ground colour in two specimens green, in one copper-coloured, somewhat lustrous. In two specimens the pronotum is intensively purple when the light hits the surface in direction from the front, in another specimen it is greenish blue. Elytra reflecting light in all colours of the spectrum in two specimens, in one it is only shining like non-oxidized copper. Tibiae black; tarsi brown. Antennae brown, only antennomeres 9–11 somewhat darker. Underside black.

Head: Frons narrow and slightly convex longitudinally, its width corresponding to the length of antennomere 2. Genae very narrow and very little raised, anteriorly terminating behind the middle part of the fronto-clypeal suture. Fronto-clypeal suture only slightly incised, situated just in front of the eyes. Clypeus stretched forwards, convex longitudinally, with small, not very closely set punctures; punctures of frons smaller and more widely separated. Mentum reversely trapezoidal. Underside of neck narrowly grooved transversely, covered with large, superficial, not very closely set punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Moderately convex transversely and longitudinally. Lateral margins narrowing anteriorly, straight in the posterior half, bent in the anterior half. Front corners rounded. Anterior margin very slightly excavated. Lateral and anterior margins continuously and narrowly bordered. Lateral borders in dorsal view visible. Front and hind corners in lateral view rounded, slightly obtuse. Surface with small, irregularly set punctures.

Scutellum: Triangular, sides slightly bent.

Elytra: Slightly oblong, oval, strongly convex transversely, somewhat less convex longitudinally. Maximum height and width about in the middle. Shoulders slightly prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view very narrowly visible. With rows of medium-sized punctures; distance between punctures on disc in row 4 about 3–4 times diameter of a puncture; about 15 punctures in row 4; some punctures are connected by very faint lines. Intervals flat, with very small, distinct punctures; some punctures in the posterior part are origin of very tiny hairs (just visible at 50-fold magnification).

Prosternum: Anterior margin narrowly bent upwards, somewhat retracted towards apophysis in the middle, forming an obtuse angle. Lateral margins of apophysis along procoxae widened and raised, space in between with a shallow, wide groove. Apophysis behind procoxae stretched backwards, with subparallel sides, broadly pointed apically and somewhat raised in the middle; apophysis with tender hairs of medium length.

Mesosternum: Short, surface rough. Anterior margin somewhat excavated in the middle.

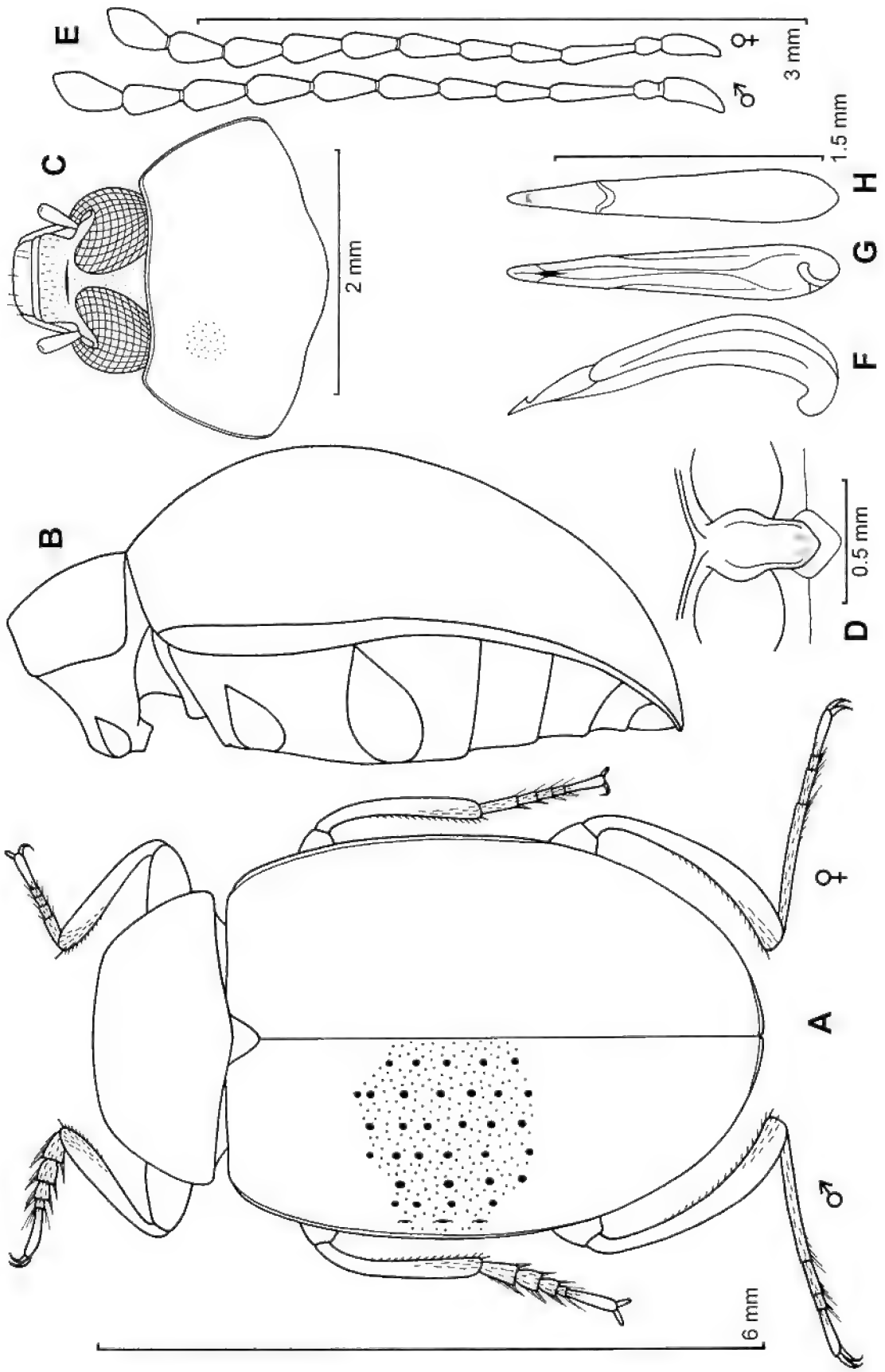


Fig. 29. *Amarygmus eureos* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antennae ♂ and ♀. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

Metasternum: Lustrous. Anterior apophysis behind anterior margin slightly raised like a hump. Disc smooth, with tiny, widely separated punctures. Median line depressed on its whole length.

Sternites: Opaque. Sternites 1 and 2 with sparse, tiny punctures. Sternite 5 apicomedially distinctly depressed in male.

Antennae: Long, reaching to about middle of elytra, slightly shorter in females than in the male (holotype damaged, with 10 antennomeres on the left side, 7 on the right side). Length/width ratio of antennomeres 1–10 in male equals to 16:6 / 8:5 / 21:5 / 12:5 / 13:5 / 14:6 / 16:7 / 14:7 / 16:7 / 15:7.

Legs: Short. Femora thickened towards the second third. Tibiae slightly thickened apically; protibiae straight on outer side, widened in the apical half on inner side; mesotibiae slightly bent on outer side, straight in the apical two-thirds on inner side; metatibiae slightly bent in the basal half, increasingly incurved in the apical half. Protarsomeres 1–3 widened, somewhat prolonged in male. Lengths of protarsomeres 1–5 as 13:10:7:5:21, lengths of mesotarsomeres 1–5 as 16:10:7:6:22, lengths of metatarsomeres 1–4 as 49:14:9:22.

Aedeagus: See Fig. 29F–H.

Amarygmus expeditus **n. sp.**
(Fig. 30A–H)

Holotype (♂): Borneo, Malaysia, Sabah, Kota Kinabalu, Inanam, 22.II.2006, R. Grimm (CG).

Paratypes: Same data as holotype (13 CG, 3 ZSMB, 2 sex not determined BMNH). – Sabah, Malaysia, Kota Kinabalu, Bukit Padang, 2.XII.2006, R. Grimm (4 ♂♂, 3 ♀♀ CG; 1 ♀ ZSMB). – Sabah, Borneo, Kota Kinabalu, nachts, auf Baumrinde, Alleebäume, 11.VIII.2007, Ulf Bremer leg. (1 ♂, 1 ♀ ZSMB). – Borneo, Malaysia, Sabah, Kudat, Bak Bak, 14.–16.II.2006, R. Grimm (22 CG, 7 ZSMB, sex not determined). – Borneo, Malaysia, Sabah, 24 km NE Keningau (Apin Apin), 500 m, 18.II.2006, R. Grimm (1 ♂ CG). – Borneo, Malaysia, Sabah, Keningau, 300 m, 20.–22.III.2007, R. Grimm (1 ♂ CG). – Near Keningau, Borneo, 30.VI.1989 (1 ♂ CM). – Malaysia, Sabah, Sepilok, 29.–30.XI.2006, R. Grimm (2 ♂♂ CG). – Malaysia, Sabah, Sandakan, 30.XI.2006, R. Grimm (2 ♂♂ CG, 4 ♀♀ CG). – Malaysia, Borneo, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 20–150 m, 13.–15.III.2008, R. Grimm (6 ♂♂ CG, 1 ♂ ZSMB, 2 ♀♀ CG, 1 ♀ ZSMB). – Malaysia, Borneo, Sarawak, Kuching, Reservoir Park, 50 m, 4.–5.III.2008, R. Grimm (1 ♂ CG). – Malaysia, Borneo, Sarawak, NW Kuching, Matang, 19.III.2008, R. Grimm (1 ♀ CG).

Circumstances of collection: Mainly collected in parks or avenues, on tree bark at night.

Etymology

Expeditus (Lat.) = put in order.

Diagnosis

Small, oval, with wide frons and short clypeus. Elytra with rows of medium-sized punctures and flat intervals. Pronotum wide, with small, distinct punctures. Upperside mostly greenish (see colouration below), legs brown. Males with widened protibiae in apical two-thirds on inner side. Metatarsomere 1 relatively short.

Amarygmus expeditus n. sp. belongs to a group of small species with wide frons and puncture rows on the elytra. *A. expeditus* is especially similar to *A. murutensis* n. sp. which also has a relatively short metatarsomere 1. However, *A. murutensis* is on average smaller (body length 3.92–4.16 mm), the pronotum is narrower, the shoulders show a markedly greenish colour (not so or less expressed in *A. expeditus*), and the male protibiae have no apical widening on the inner side.

Description

Measurements: Body length 4.01–5.10 mm; body width 2.65–2.90 mm. – Ratios: Pronotum: width/length 1.94–2.04; width hind corners/width front corners 1.63–1.67. Elytra: length/width 1.30–1.37; length elytra/length pronotum 3.30–3.52; maximum width elytra/maximum width pronotum 1.25–1.31.

Colouration: Frons and pronotum green, with a slight purple iridescence, in most specimens with a slight lustre, in some with a marked lustre. Elytra either weakly green or weakly purple, slightly lustrous, in some specimens with a bluish tinge. Green colouration of the margins of pronotum not encroaching onto shoulders of elytra (in *A. murutensis* n. sp. clearly encroaching onto shoulders of elytra). Prosternum brown, remaining parts of underside black. Femora dark brown, tibiae brown, tarsi somewhat lighter brown than tibiae. Antennomeres 1–5 brown, 6 dark brown, 7–11 black.

Head: Frons wide, somewhat wider than combined length of antennomeres 2–4 (like 26 : 22), with small punctures which are somewhat irregularly set. Genae only slightly raised, anteriorly terminating in front of the level of the middle part of the fronto-clypeal suture. Fronto-clypeal suture deeply incised and somewhat depressed in its middle part. Clypeus slightly stretched forwards, markedly convex longitudinally, slightly convex transversely; punctures as on frons except that there are short recumbent hairs on clypeus. Mentum widened anteriorly, with bent sides, transition between sides and base rounded; lateral margins flat, lustrous, space in between distinctly convex. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Wide, uniformly but not strongly convex transversely, slightly convex longitudinally. Borders of the lateral margins clearly separated from the convexity of the central part of the pronotum. Lateral margins narrowing anteriorly. Front corners widely rounded. Anterior margin somewhat excavated. Lateral and anterior margins continuously and distinctly bordered. Lateral borders in dorsal view widely exposed. Front corners in lateral view

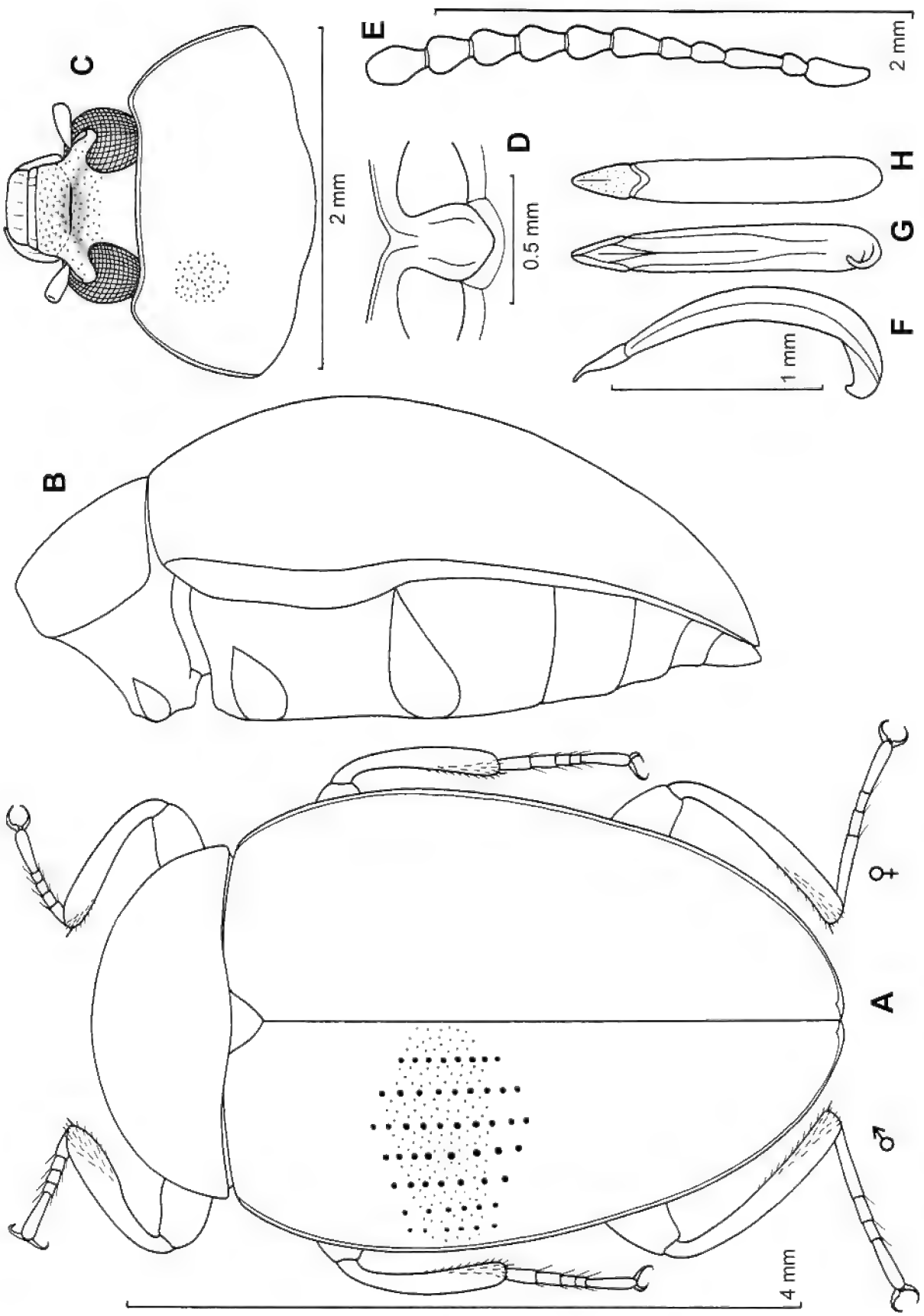


Fig. 30. *Amarygmus expeditus* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

rounded, hind corners angular, obtuse. Surface with small, distinct, and rather closely set punctures.

Scutellum: Triangular, with some minute punctures.

Elytra: Oval, markedly convex transversely, slightly less convex longitudinally. Maximum width and height at the level of the anterior third. Shoulders rounded. Apices of elytra mutually rounded. Lateral edges in dorsal view visible over their whole length. With rows of medium-sized, rather narrowly set punctures; distance between punctures on disc ½–1 times diameter of a puncture; about 30 punctures in row 4. Intervals not convex, with very small, distinct, not very closely set punctures.

Prosternum: Anterior margin continuously bent upwards, somewhat retracted towards apophysis in the middle. Apophysis oval, widest posterior to procoxae; lateral margins only slightly raised, thus space in between only with a shallow, wide groove.

Mesosternum: Hind part short, wide; anterior margin markedly excavated in the middle; lateral margins with an uneven surface, contrasting with the flat, lustrous centre.

Metasternum: Anterior margin between mesocoxae rounded, bordered. Anterior part of disc with very large, closely set punctures, posterior part with very small, widely separated punctures. Median line indistinctly incised.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, weakly bordered; inner part of this border and inner part of the borders behind metacoxae with punctures. Anterior half of sternite 1 with small punctures, posterior half of this sternite and subsequent sternites with minute to tiny punctures which are the origin of very short recumbent hairs. Sternite 5 apicomedially depressed in males.

Antennae: Of medium length, reaching to anterior third of elytra, in females negligibly shorter than in males. Antennomere 11 rounded apically. Length/width ratio of antennomeres 1–11 in male equals to 11:7 / 6:4 / 10:4 / 6:4½ / 6:4½ / 10:6 / 9:6½ / 9½:7½ / 9½:7½ / 9:7½ / 13:8.

Legs: Short. Femora thickened towards the second third. Protibiae straight on outer side, in males in the apical two-thirds on inner side widened, flattened and impunctate. Meso- and metatibiae somewhat bent basally, straight apically. Protarsomeres 1–3 not widened in males. Lengths of protarsomeres 1–5 as 5:4:4:4:15, lengths of mesotarsomeres 1–5 as 9:5:4½:4:15, lengths of metatarsomeres 1–4 as 16:8:5:15.

Aedeagus: See Fig. 30F–H.

Amarygmus gnitus **n. sp.**
(Fig. 31A–H)

Holotype (♂): Borneo, Malaysia, Sabah, Sepilok, 12.–13.III.2007, R. Grimm (CG).

Paratype: Same data as holotype (1 ♀ ZSMB).

Circumstances of collection: Edge of lowland primary forest, on tree bark, at night.

Etymology

Gnitus (ancient Lat.) from gnoscere, gnovi = mysterious, concealed.

Diagnosis

Small, oval, moderately convex, with a very narrow frons. Pronotum bluish green, elytra reddish brown, legs brown. Elytra with rows of rather large, widely separated punctures. Antennae of medium length. Protarsomeres 1–3 slightly widened in male. Aedeagus with a special shape (Fig. 31F–H).

The only known species with a very narrow frons and rows of punctures on elytra is *A. powanpowanus* Masumoto et Makihara, 1997 (described as *A. nemestrinus* in Bremer 2006b: 18–19, fig. 3) from Sumatra, the Malayan Peninsula and Sarawak. This species is very similar to *A. gnitus*. *A. powanpowanus* is somewhat longer and wider than *A. gnitus* (body length 5.37–5.65 mm), the elytra are more convex longitudinally, the lateral elytral intervals are flat (convex in *A. gnitus*), and the female antennae are somewhat longer (only females are known of *A. powanpowanus*).

A. praecellens n. sp. from Sarawak resembles *A. gnitus* in the narrow frons, the shape of the tibiae, and the greenish blue pronotum. However, *A. praecellens* has striae on elytra (puncture rows in *A. gnitus*) and is somewhat longer (body length 5.41–6.28 mm).

Description

Measurements: Body length 5.21+5.33 mm; body width 3.07+3.09 mm. – Ratios: Pronotum: width/length 2.02+2.05; width hind corners/width front corners 1.78+1.83. Elytra: length/width 1.36+1.39; length elytra/length pronotum 3.67+3.72; maximum width elytra/maximum width pronotum 1.31+1.34.

Colouration: Pronotum and head greenish blue, lustrous. Elytra reddish brown (slightly lustrous). Legs brown (basal half of tibiae somewhat darker than apical half). Antennomeres 1–5 brown, 6–11 black (antennomere 11 apically brightened). Underside brown, slightly lustrous.

Head: Frons very narrow, as wide as the diameter of one ocellus of the eye, with a few very small punctures. Genae narrow, raised, anteriorly terminating approximately at the level of the middle part of the fronto-clypeal suture. Fronto-clypeal suture depressed and slightly incised in the middle. Clypeus stretched forwards, lustrous, moderately convex longitudinally and transversely, covered with small, rather closely set punctures. Mentum reversely trapezoidal, lateral margins wide, flat, lustrous, space in between microreticulated, convex. Underside of

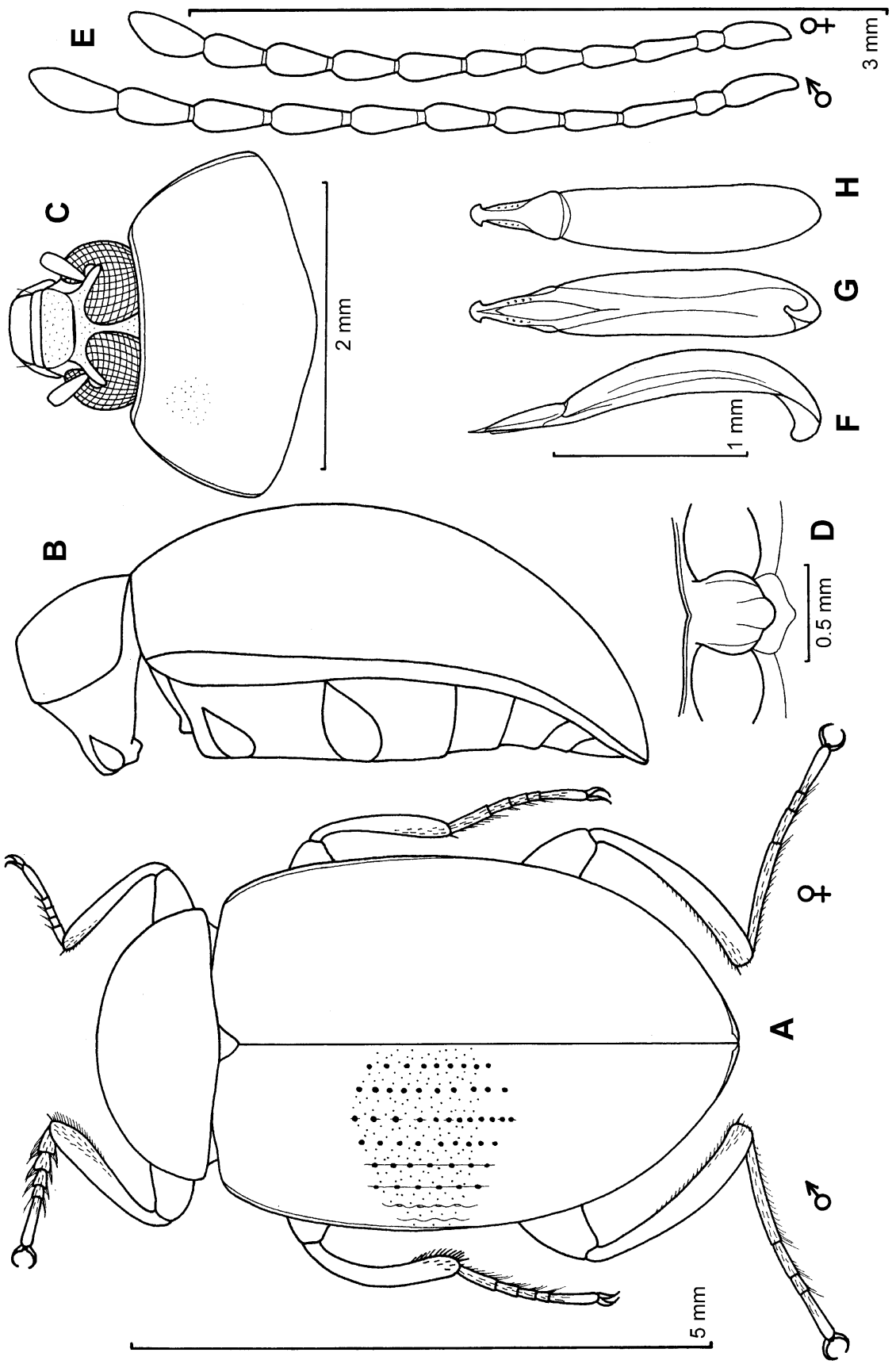


Fig. 31. *Amarygmus gnitus* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antennae ♂ and ♀. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

neck strongly microreticulated, with coarse, transversely aligned punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Wide. Lateral margins narrowing anteriorly, slightly bent. Hind corners in dorsal view angular, obtuse; front corners widely rounded, obtuse. Anterior margin slightly excavated. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view very narrowly visible. Front and hind corners in lateral view obtuse. Surface with very small, widely separated punctures.

Scutellum: Triangular, impunctate.

Elytra: Slightly elongate oval, moderately convex transversely and longitudinally. Maximum width and height shortly anterior to the middle. Shoulders moderately prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view very narrowly visible. With rows of large punctures, distance between punctures on disc 1–2 times diameter of a puncture; about 26 punctures in row 4. Intervals on disc flat, laterally and apically convex.

Prosternum: Anterior margin continuously and narrowly bent upwards, somewhat retracted towards apophysis and obtuse-angled in its middle. Apophysis oval, margins along procoxae widened and distinctly raised, space in between with a wide, deep groove; posterior to coxae sides narrowing, apically narrowly rounded; surface of apophysis with some long erect hairs.

Mesosternum: Wide, short. Anterior margin moderately excavated in the middle.

Metasternum: Anterior margin between mesocoxae widely rounded, coarsely bordered. Anterior part of disc with medium-sized punctures, posterior part with tiny, widely separated punctures; these punctures are origin of tender, mostly recumbent hairs of medium length. Median line slightly incised in the posterior part.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, very coarsely bordered. Sternites impunctate. Sternite 5 apicomedially scarcely depressed in male.

Antennae: Of medium length, reaching slightly anterior to middle of elytra. Length/width ratio of antennomeres 1–11 in male equals to 15:6 / 6:5 / 14:5 / 11:5 / 14:6 / 14:7 / 15:7 / 16:7 / 16:7 / 15:7 / 20:8, in female to 12:6 / 6:5 / 13:5 / 10:5 / 12:5½ / 12:6 / 13:7 / 13:7 / 12:7 / 12:7 / 17:7.

Legs: Of medium length. Femora slightly surpassing the sides of the body, thickened towards their second third. Protibiae straight, in male apically on inner side slightly widened and in the apical third with short, closely set hairs; meso- and metatibiae bent, mesotibiae in male on inner side in the apical third with short, closely set hairs. Protarsomeres 1–3 slightly widened in male. Lengths of protarsomeres 1–5 in male as 7:5:5:4:23, lengths of mesotarsomeres 1–5 as 13:9:7:5:22, lengths of metatarsomeres 1–4 as 39:15:9:21.

Aedeagus: Top of parameres widened, on their anterior part with tiny tubercles and pores (visible at 100-fold magnification) (Fig. 31F–H).

Amarygmus inconditus **n. sp.**
(Fig. 32A–H)

Holotype (♂): Borneo, Malaysia, Sabah, E Apin Apin, 25 km E Keningau, 21.III.2007, R. Grimm (CG).

Paratypes: Borneo, Malaysia, Sabah, 24 km NE Keningau (Apin Apin), 500 m, 18.II.2006, R. Grimm (1 ♀ ZSMB). – Borneo, Malaysia, Sabah, Tenom, 300 m, 8.–9.II.2006, R. Grimm (1 ♀ CG). – Sarawak, Kapit. Dist., Sebong, Baleh riv., 9.–21.III.1994, J. Horák leg. (1 ♂ ZSMB; without antennae).

Circumstances of collection: On the bark of a tree in a garden (in Apin Apin), at night; on the bark of a tree at edge of primary forest (in Tenom), at night.

Etymology

Inconditus (Lat.) = disordered.

Diagnosis

Of medium size, elongate oval. Elytra with rows of large, variable, mostly elongate punctures which are violet, blue or purple; intervals plain on disc and very closely punctured, punctures medium-sized. Frons extremely narrow in both sexes. Pro- and mesotarsomeres 1–3 markedly widened in males. Antennae long and slender, in females about as long as in males. Metatarsomere 1 very long. Underside bare in males. Aedeagus with a barbed hook dorsally at the tip.

Amarygmus inconditus n. sp., *A. fulgurans* Gebien, 1927 (redescribed in Bremer 2003b: 55–56), *A. eureos* n. sp., and *A. erilis* n. sp. form a group of species with a similar body shape, narrow frons, long antennae, and similar aedeagus. *A. inconditus* differs from these species by the violet, blue or purple colouration of the punctures of the elytral rows and the very closely set punctures on the elytral intervals. Moreover, *A. fulgurans* and *A. erilis* have striae on the elytra (rows of large, variable punctures in *A. inconditus*). *A. eureos* has, like *A. inconditus*, rows of large punctures on the elytra, but these punctures have no violet or purple colouration, and the punctures on the elytral intervals are smaller.

A similar punctation and colouration of the punctures of the elytral rows is present in *A. mitschkei* (Pic, 1938) (redescribed in Bremer 2003a: 67–69) and *A. selatanus* (Masomoto et Makihara, 1997) (described as *A. bellulus* in Bremer 2003a: 86–93). Both species differ from *A. inconditus* by the oblong and narrow body shape, the aedeagus without a barbed hook, the nearly parallel elytra, the wider frons, and the much shorter antennae.

Description

Measurements: Body length 5.89–6.85 mm; body width 3.26–3.74 mm. – Ratios: Pronotum: width/length 2.00–2.15; width hind corners/width front corners 1.66–1.79. Elytra: length/width 1.45–1.57; length elytra/length pronotum 3.89–4.24; maximum width elytra/maximum width pronotum 1.26–1.34.

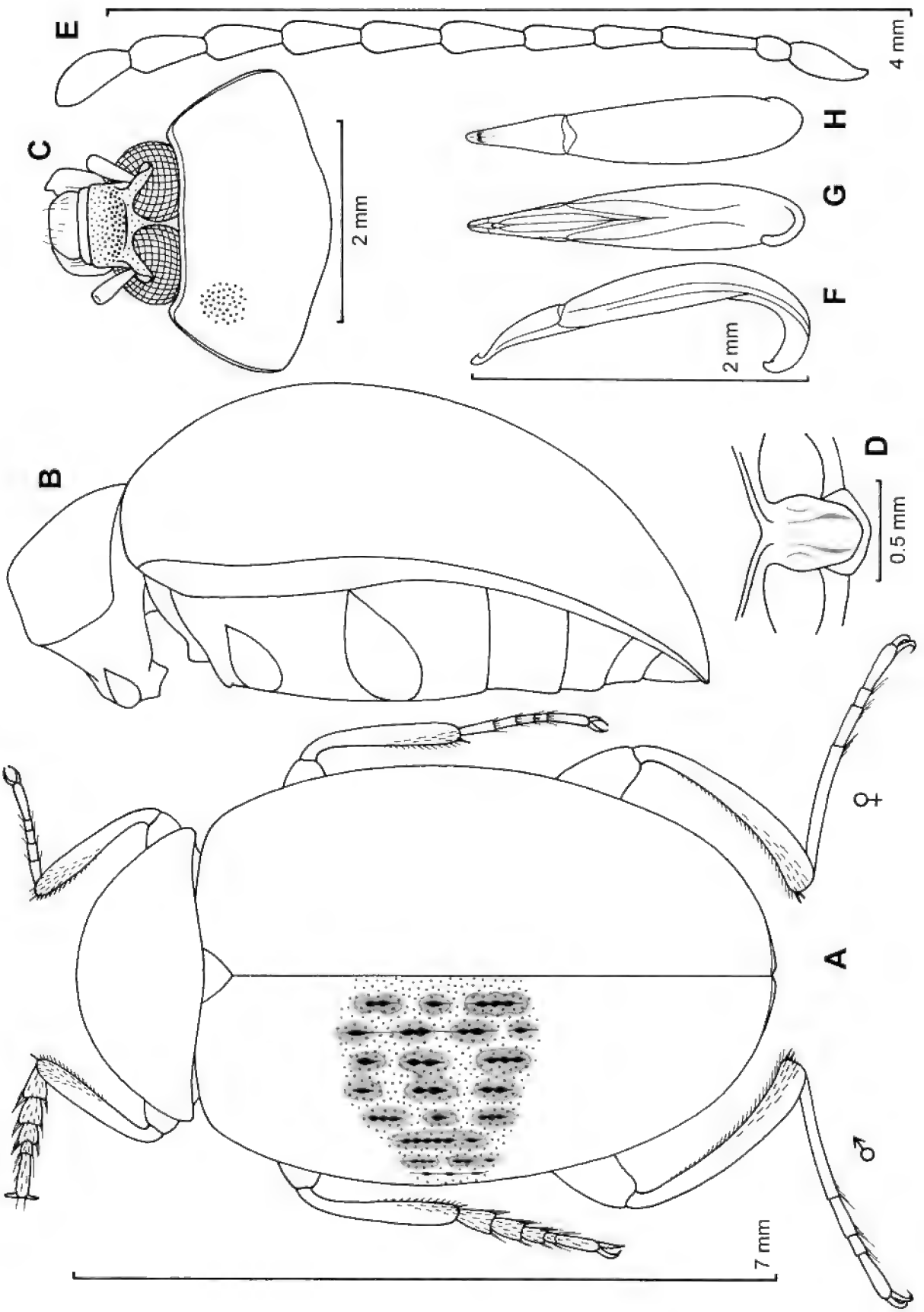


Fig. 32. *Amarygmus inconditus* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

Colouration: Upperside greenish golden, strongly microreticulated, with a markedly reduced lustre. Pronotum with a violet iridescence. Punctures of the elytral rows on a blue, violet or purple ground and with a narrow halo around it; the halos of approximate punctures may fuse and then circumvent two or more punctures. Underside black, somewhat lustrous. Femora and tibiae black, tarsi brown. Antennomeres 1–5 brown, 6–11 black.

Head: Frons as wide as 1–2 ocelli of the eye. Genae slightly raised, reduced to a narrow clasp which is situated anterolateral to the eyes. Fronto-clypeal suture slightly incised, situated just in front of the eyes. Clypeus stretched forwards, slightly convex transversely and longitudinally, with indistinct, small, rather closely set punctures and tiny hairs originating from them. Mentum reversely trapezoidal. Underside of neck with small, indistinct punctures. Outer surface of mandibles with a longitudinal sulcus, apically bifid.

Pronotum: Short, uniformly and markedly convex transversely, slightly convex longitudinally. Lateral margins narrowing anteriorly, bent. Anterior margin straight. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view narrowly visible. Front corners in lateral view rounded, obtuse; hind corners more angular and more obtuse-angled than front corners. Surface with small, rather closely set punctures.

Scutellum: Triangular, with somewhat bent sides and minute punctures.

Elytra: Elongate oval, strongly convex transversely, markedly convex longitudinally. Maximum height and width about in the middle. Shoulders rounded. Apices of elytra mutually rounded. Lateral edges in dorsal view visible only in the middle part of the elytra. With rows of large, mostly elongate punctures which are variable in size and distance; punctures of the first two rows smaller and partly connected by lines, in the other rows punctures usually widely separated, some punctures, however, nearly touching each other (in the latter case with a coloured halo around them). Intervals flat on disc, slightly convex laterally, with small, distinct, very closely set punctures.

Prosternum: Anterior margin narrowly bent upwards, slightly retracted in the middle, forming an obtuse angle. Apophysis distinctly projecting backwards, widening along procoxae, behind coxae somewhat convergent, apically broadly pointed; space between coxae with a rather wide groove.

Mesosternum: Hind part short, obliquely descending to the lower anterior part, on each side with a longitudinal sulcus; anterior margin widely but not deeply excavated.

Metasternum: Anterior margin between mesocoxae narrowly rounded, bordered. Disc with minute, indistinct, widely separated punctures. Median line incised on its whole length.

Sternites: More opaque than metasternum. Anterior margin of sternite 1 between metacoxae acute-angled, with straight sides, indistinctly bordered. Sternites 1–3 with indistinct, tiny, widely separated punctures. Sternite 5 apicomedially markedly depressed in males, at the anterior edge of the depression with some long hairs.

Antennae: Long, tender, reaching to about middle of elytra. Length/width ratio of antennomeres 1–11 in male equals to 19:7 / 9:6 / 24:6 / 17:6 / 16:6 / 19:7 / 20:7 / 19:7½ / 18:7½ / 18:7½ / 21:7½.

Legs: Short. Femora thickened towards the second third; profemora with medium-sized, distinct, not very closely set punctures. Protibiae straight, very slightly concave on outer side. Mesotibiae straight, in male short erect hairs in the apical half on inner side. Metatibiae apically incurved. Pro- and mesotarsomeres 1–3 widened in male. Lengths of protarsomeres 1–5 in male as 12:11:8:6:26, lengths of mesotarsomeres 1–5 as 17:13:11:6:25, lengths of metatarsomeres 1–4 as 52:18:8:26.

Aedeagus: See Fig. 32F–H.

Amarygmus iunctus **n. sp.**
(Fig. 33A–H)

Holotype (♀): Malaysia, Sabah, Keningau, 24.–27.IX. 2006, R. Grimm (CG).

Paratypes: Borneo, Malaysia, Sabah, Tenom, 300 m, 18.III.2007, R. Grimm (1 ♂ CG). – Borneo, Malaysia, Sabah, Tambunan, 500 m, 4.II.2006, R. Grimm (1 ♂ damaged, ZSMB). – Malaysia, Borneo, Sarawak, Kuching, Reservoir Park, 50 m, 22.III.2008, R. Grimm (1 ♀ CG).

Circumstances of collection: On tree bark in parks, at night.

Etymology

Iunctus (Lat.) = joined (to *A. decorosus* Bremer, 2003).

Diagnosis

Very small, oblong, oval. Striae on elytra with small, elongate punctures, elytral intervals closely punctured. Eyes nearly touching each other on frons in both sexes. Elytra with a reddish brown macula as shown in Fig. 33A. Underside bare in males.

A. decorosus Bremer, 2003 (Bremer 2003b: 52–54) from northern Thailand has the same size and shape and a very similar elytral macula as *A. iunctus*. However, *A. decorosus* has no separate lateral reddish yellow macula, the shape of the main macula differs slightly, the frons is slightly wider, the clypeus is longer, the prosternal apophysis is somewhat lifted apicomedially (not so in *A. iunctus*), and the male antennomeres 3+4 are of same length and width (antennomere 3 very short and narrow, antennomere 4 very long and wide in *A. iunctus*).

The male antennomeres of *A. iunctus* are comparable to *A. alteritas* Bremer, 2004 from Sulawesi (Bremer 2004b: 30–33), but *A. alteritas* has no maculae on the

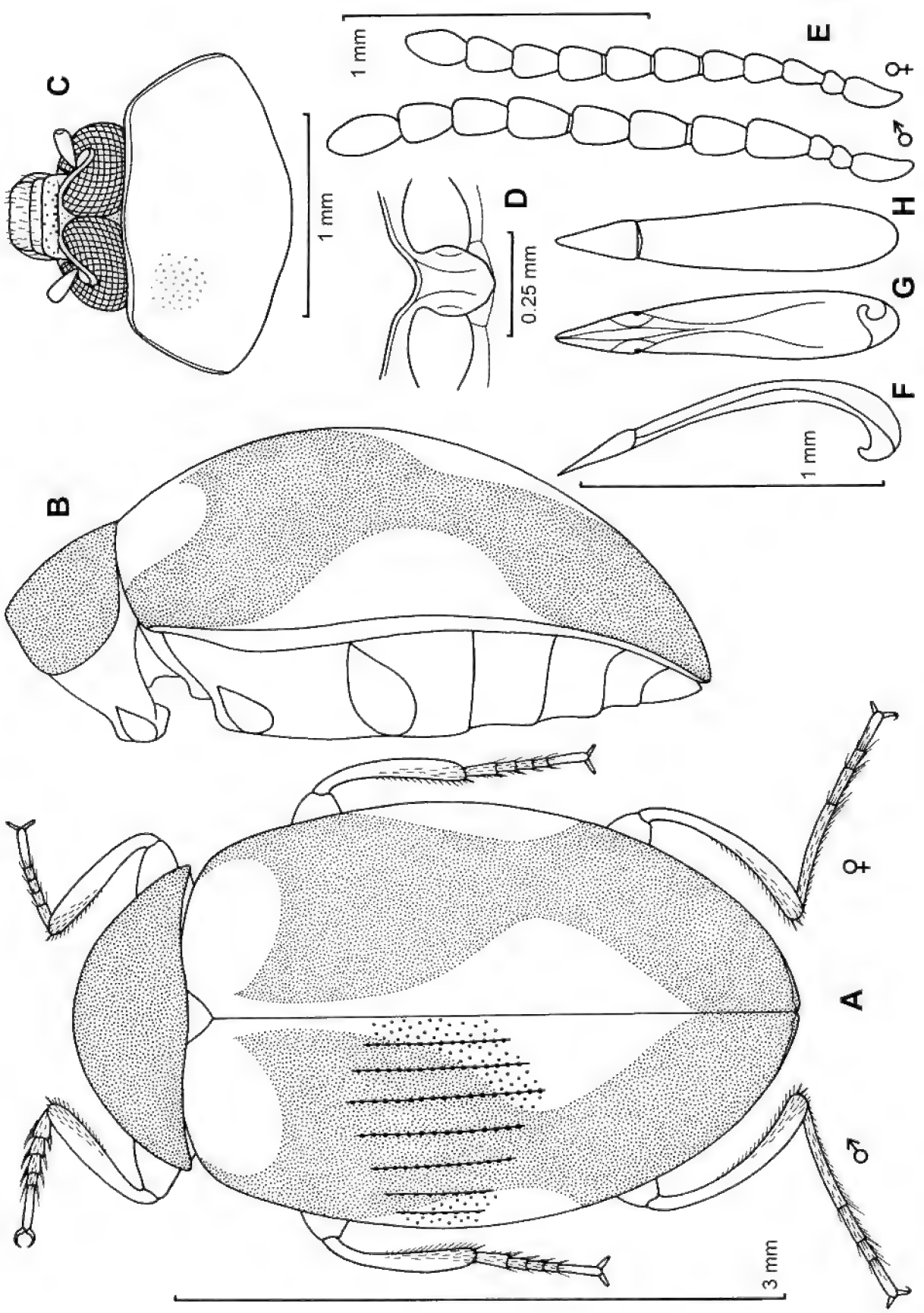


Fig. 33. *Amarygmus iunctus* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antennae ♂ and ♀. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

elytra and antennomeres 3+4 are short whereas antennomere 5 is very long and wide.

Also *A. tenuifrons* Bremer, 2006 from Sabah (Bremer 2006b: 19–21, fig. 4) with a similar body shape as *A. iunctus* has peculiar male antennomeres, but it is larger (body length 5.18 mm) and there are no maculae on the elytra.

Description

Measurements: Body length 3.42–3.50 mm; body width 1.91–1.98 mm. – Ratios: Pronotum: width/length 1.85–1.97; width hind corners/width front corners 1.45–1.63. Elytra: length/width 1.43–1.47; length elytra/length pronotum 3.55–3.85; maximum width elytra/maximum width pronotum 1.30–1.33.

Colouration: Frons and pronotum black, greasy shining. Elytra black like the pronotum but with the reddish brown maculae as shown in Fig. 33A. Underside brown, lustrous, except the black underside of neck and the black sternites 4 and 5. Legs light brown. Antennomeres 1–6 brown, 7–11 black (antennomere 11 apically brightened).

Head: Frons very narrow in both sexes, the eyes either touching each other in the middle, or their distance narrower than the diameter of one ocellus of the eye. Genae very narrow, slightly raised. Fronto-clypeal suture scarcely incised, situated just in front of the eyes. Clypeus extremely short, covered with small, widely separated punctures. Mentum narrow, reversely trapezoidal, with wide, flat margins laterally; space in between transversely convex. Underside of neck impunctate. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Strongly convex transversely, less convex longitudinally. Lateral margins narrowing anteriorly, nearly straight. Front corners rounded. Anterior margin nearly straight, in its middle slightly protruding towards head. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view narrowly visible. Front and hind corners obtuse in lateral view, rounded. Surface markedly microreticulated, with small, irregularly set punctures.

Scutellum: Triangular, with a few tiny punctures.

Elytra: Oblong, oval, markedly convex longitudinally. Maximum width at the level of the anterior third, sides narrowing and rounded posteriorly. Shoulders not rounded. Apices of elytra mutually rounded. Lateral edges not visible in dorsal view. With superficial striae with elongate, small, indistinct punctures. Intervals flat on disc, very slightly convex in the lateral posterior parts and near the apex; punctures on intervals very closely set, nearly as large as punctures of the striae.

Prosternum: Very short. Anterior margin continuously and narrowly bent upwards, markedly retracted towards apophysis in its middle. Apophysis along procoxae rounded and margins raised, space in between with a groove; margins posterior to coxae somewhat narrowing; apically rounded.

Mesosternum: Hind part very narrow, short; anterior margin somewhat excavated in the middle; lateral margins subparallel, somewhat raised.

Metasternum: Anterior margin between mesocoxae narrowly rounded, distinctly bordered. Disc slightly convex, with tiny, widely separated punctures. Median line shallowly incised up to the anterior apophysis.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, not bordered. Sternites with very small, widely separated punctures.

Antennae: Of medium length, reaching slightly anterior to middle of elytra. Antennomere 11 rounded apically. Antennomere 3 short and relatively narrow in males (not longer than antennomere 2), antennomere 4 long and wide. Antennomere 3 in female longer than in male, of equal length and shape as antennomere 4. Length/width ratio of antennomeres 1–11 in male equals to 10:4 / 3½:3 / 3:3 / 11:6 / 8:6 / 9:6 / 9:6 / 9½:6 / 9:6 / 8:6 / 13:5, in female to 9:4 / 4:3 / 7:3 / 8:4½ / 7½:5 / 8:5 / 8:5 / 8:5 / 8:5 / 7:5 / 13:5.

Legs: Short. Femora flattened, moderately thickened in the middle. Protibiae nearly straight, mesotibiae slightly bent, metatibiae strongly bent. Protarsomeres 1–3 somewhat enlarged in males. Lengths of protarsomeres 1–5 as 4:3:3:3:10, lengths of mesotarsomeres 1–5 as 9:5:4:4:9, lengths of metatarsomeres 1–4 as 23:10:5:10.

Aedeagus: See Fig. 33F–H.

Amarygmus (Pyanirygmus) magnus **n. sp.**
(Fig. 34A–H)

Holotype (♂): Sabah, Borneo, vic. Ranau, 22.IV.2007, S. Chew leg. (ZSMB).

Paratypes: Borneo, Malaysia, Sabah, Tambunan, 500 m, 28.–31.III.2007, Lux, R. Grimm (1 ♂ CG). – Borneo, Malaysia, Sabah, Crocker Range, Gunung Alab, V.2005, S. Chew leg. (1 ♀ CG).

Circumstances of collection: In Tambunan at the edge of secondary forest, at light.

Etymology

Magnus (Lat.) = large.

Diagnosis

Very large. Upperside dark brown, lustrous. Elytra very oblong and relatively wide, with subparallel sides, relatively slightly convex transversely. Elytra with rows of very small, closely set punctures; intervals flat, impunctate. Pronotum on disc relatively flat, anterior margin deeply excavated, with subparallel sides in the posterior half. Legs long and slender, male protibiae with a slight widening in the apical three-fifths on inner side. Metatarsomere 1 shorter than metatarsomere 4. Antennae not very long, slender, in males longer than in females. Parameres of the aedeagus narrowed in its middle part.

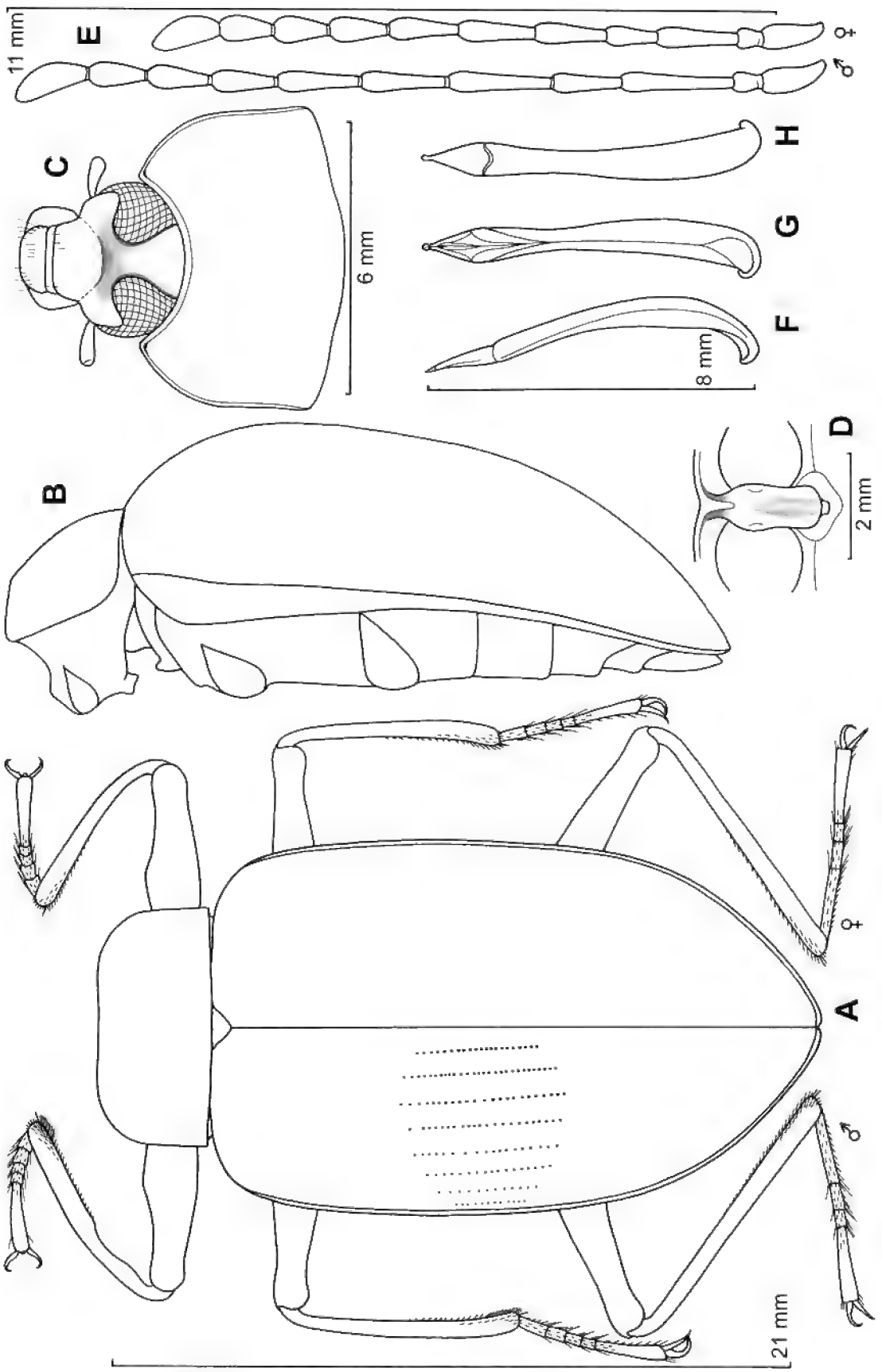


Fig. 34. *Amarygmus (Pyanirygmus) magnus* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antennae ♂ and ♀. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

A. magnus is similar to *A. (Pyanirygmus) maruyamai* (Masumoto, 1989) from Sabah (MASUMOTO 1989c: 561–562, figs. 11, 40–42), but *A. magnus* is larger (body length of *A. maruyamai* 17–20 mm), the pronotum is markedly wider and less convex, and the pronotal sides are subparallel in its posterior half (in *A. maruyama* maximum width at the pronotal base and sides narrowing and bent anteriorly).

Description

Measurements: Body length 21.3–23.1 mm; body width 10.8–11.5 mm. – Ratios: Pronotum: width/length 1.70–1.92; width hind corners/width front corners 1.67–1.73. Elytra: length/width 1.59–1.63; length elytra/length pronotum 4.15–4.46; maximum width elytra/maximum width pronotum 1.43–1.51.

Colouration: Upperside dark brown, lustrous. Legs and antennae blackish brown. Underside blackish brown to black, lustrous.

Head: Frons moderately wide, in both sexes of the same width; width in females corresponding to length of antennomere 4, in males distinctly narrower than length of antennomere 4 (like 19 : 25); frons descending longitudinally to the markedly depressed fronto-clypeal suture. Genae raised, anteriorly terminating in front of the level of the middle part of the fronto-clypeal suture. Middle part of the fronto-clypeal suture arched, markedly depressed but only slightly incised, lateral parts slightly incised. Clypeus moderately stretched forwards, convex longitudinally. Clypeus and frons with very faint and widely separated punctures. Mentum with subparallel sides in its anterior three-fourths, roundedly convergent in its basal fourth, base straight; lateral margins flat, space in between increasingly convex anteriorly. Underside of neck with small, shallow punctures. Outer surface of mandibles with a longitudinal sulcus, apically notched at the point where the exterior sulcus meets the apex.

Pronotum: Markedly wider than long; on disc moderately convex transversely. Lateral margins between the middle of the pronotum and the hind corners distinctly pressed downwards, subparallel at this part, bent and convergent anterior to the middle. Anterior margin strongly excavated. Front corners markedly projecting (but not pointed). Lateral and anterior margins continuously bordered, border of anterior margin wide. Lateral borders in dorsal view well visible. Front corners in lateral view rectangular, hind corners pointed, slightly obtuse. Surface covered with tiny punctures (visible at 50-fold magnification) and tiny hairs originating from these punctures (visible at 100-fold magnification).

Scutellum: Triangular, with bent sides, impunctate.

Elytra: Long and wide, slightly convex transversely and longitudinally, lateral margins straight in their middle. Maximum height somewhat anterior to the middle. Shoulders prominent. Apex of each elytron somewhat retracted towards suture. Lateral edges in dorsal view widely visible (except area along shoulders), especially widely visible at the apex. With rows of small, closely set punctures; distance between punctures equal to the diameter of a puncture; about 76 punctures in row 4. Intervals flat, impunctate on disc, with tiny punctures at the apex; tiny hairs originating from punctures near apex (visible at 100-fold magnification).

Prosternum: Anterior margin narrowly bent upwards, somewhat retracted towards apophysis in the middle, a narrow, long keel originating from the middle of the anterior margin, extending on the apophysis to the level of the procoxae. Apophysis long, narrow, protruding to the back, slightly widened along procoxae, space in between scarcely grooved, with a distinct median groove behind coxae; somewhat widened posterior to coxae; apex pointed and distinctly lifted, anterior to the lifted part with a transverse groove.

Mesosternum: Hind part long, narrow; anterior margin excavated in the middle; lateral margins convergent posteriorly, with a longitudinal depression.

Metasternum: Anterior margin between mesocoxae widely convex, bordered. Some small, indistinct punctures just behind anterior margin, tiny punctures and tiny hairs on disc. Median line widely and shallowly depressed in its posterior half.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, coarsely bordered. Sternites 1 and 2 with minute and closely set punctures on the discs, sternite 3 punctated only laterally, sternites 4 and 5 less punctated. Sternite 5 bordered apically, with some long, backwards directed hairs at this border.

Antennae: Tender, relatively short, in males longer than in females. Length/width ratio of antennomeres 1–11 in male equals to 23:11 / 10:9 / 45:10 / 25:10 / 36:10 / 36:11 / 36:11 / 29:11 / 28:11 / 28:11 / 35:12, in female to 23:11 / 9:9 / 31:9 / 19:9 / 28:9 / 26:10 / 29:11 / 25:11 / 23:11 / 20:11 / 29:12.

Legs: Long, tender. Femora distinctly surpassing lateral margins of body. Femora very thin at base, somewhat thickened towards second third, the following part narrowed but slightly thickened again near apex. Protibiae in males on outer side somewhat bent at their base, straight in the apical three-fifths, on inner side in the apical three-fifths slightly wider with medium-sized hairs, the hairs becoming denser and longer in the apical fourth of the widening; in females not widened on inner side and the apical hairs not denser and longer. Mesotibiae straight, on inner side with the same pilosity as on protibiae. Metatibiae straight. Protarsomeres 1–3 not widened in males. Lengths of protarsomeres 1–5 as 10:10:9:9:52, lengths of mesotarsomeres 1–5 as 23:12:11:9:52, lengths of metatarsomeres 1–4 as 48:21:13:59.

Aedeagus: Parameres in their middle part narrowed, apically pointed and with a knob-like top (Fig. 34F–H).

Amarygmus medius **n. sp.**
(Fig. 35A–H)

Holotype (♀): Sabah, Umg. Kudat, Bäume am Strand Bak Bak, nachts auf Baumrinde, 16.II.2006, Ulf Bremer leg. (ZSMB).

Paratypes: Same data as holotype (1 ♂, 1 ♀ ZSMB; 1 ♀ CM). – Sabah, Danum Valley, 4°58'N 117°48'E, M. D. F. Ellwood, *Parashorea tomentella*, *Asplenium nidus*, East Trail 7, FogTray 4, 11.VII.1999. "448" (1 ♂, 1 ♀ BMNH). – Malaysia, Sabah, Ranau, 28.XI.2006, R. Grimm (1 ♀ CG). – Malaysia, Sabah, Tambunan, 21.XI.2006, R. Grimm (4 ♀♀ CG). – Borneo, Malaysia, Sabah, Tambunan, 500 m, 28.–31.III.2007, R. Grimm (7 CG, 2 ZSMB, sex not determined). – Malaysia, Sabah, Sepilok, 29.–30.XI.2006, R. Grimm (3 ♂♂ CG, 1 ♂ ZSMB, 1 ♀ CM). – Same data as before, but 12.–13.III.2007 (1 ♀ CG). – Indonesia, 7.–21.IX.1997, South Kalimantan, Loksado vill. 17 km NE, 1000 m, S. Jäkl leg. (1 ♀ SSB). – Malaysia, Borneo, Sarawak, Kubah NP, 250 m, 6.–8.III.2008, R. Grimm (2 sex not determined CG). – Borneo, Malaysia, Sarawak, Kubah NP, HQ vic., 100–300 m, 27.–28.III.2009, R. Grimm (1 ♀ CG). – Malaysia, Borneo, Sarawak, nr. Kubah NP, Matang Family Park, 200 m, 7.III.2008, R. Grimm (1 sex not determined CG). – Malaysia, Borneo, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 20–150 m, 21.III.2008, R. Grimm (2 sex not determined CG). – Same data as before, but 27.–28.IX.2008 (1 ♀ CG). – Borneo, Malaysia, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 10–200 m, 23.–27.III.2009, R. Grimm (1 ♂, 2 ♀♀ CG). – Same data as before, but 4.–8.IV.2009 (6 ♀♀ CG). – Malaysia, Borneo, Sarawak, Gunung Gading NP, 100–250 m, 9.–12.III.2008, R. Grimm (2 sex not determined CG). – Same data as before, but 20.III.2008 (2 sex not determined CG). – Borneo, Sarawak, Gn. Gading NP, 150–300 m, 9.–12.III.2008, leg. W. Schawaller (1 sex not determined SMNS). – Malaysia, Borneo, Sarawak, NW Kuching, Matang, 19.III.2008, R. Grimm (6 sex not determined CG). – Malaysia, Borneo, Sarawak, Kuching, Reservoir Park, 50 m, 4.–5.III.2008, R. Grimm (17 sex not determined CG). – Same data as before, but 22.III.2008 (13 CG, 15 ZSMB, sex not determined). – Same data as before, but 9.–10.IX.2008 (7 ♂♂ CG). – Borneo, Malaysia, Sarawak, Kuching, Reservoir Park, 21.–22.III.2009, R. Grimm (4 ♂♂, 5 ♀♀ CG). – Same data as before, but 8.IV.2009 (3 ♂♂, 3 ♀♀ CG). – Borneo, Malaysia, Sarawak, W Kuching, Matang, 19.IX.2008, R. Grimm (1 ♀ CG). – Borneo, Malaysia, Sarawak, Lundu, 23.–26.IX.2008, R. Grimm (1 ♀ ZSMB).

Circumstances of collection: At night on tree bark in a park near the beach (in Kudat); in parks and similar habitats (in Kuching); fogged from a tree in lowland primary forest (in Danum Valley).

Etymology

Medius (Lat.) = in the middle (of size of many species of *Amarygmus*).

Diagnosis

Of medium size, widely oval, rather flat, dark, lustrous. Elytra with rows of medium-sized, rather closely set punctures. Frons of medium width, of the same width in both sexes. Antennae in males somewhat longer than in females. Males with (not very distinct) sexual characters on sternite 5 and on meso- and metafemora.

A. sumatraselatanus Masumoto et Makihara, 1997 from Sumatra, Malayan Peninsula and Sarawak is very similar to *A. medius* n. sp. with respect to habitus and size, but can easily be distinguished from *A. medius* by its blue pronotum.

Description

Measurements: Body length 6.13–6.61 mm; body width 4.02–4.14 mm. – Ratios: Pronotum: width/length 2.00–2.06; width hind corners/width front corners 1.78–1.80. Elytra: length/width 1.28–1.35; length elytra/length pronotum 3.69–4.00; maximum width elytra/maximum width pronotum 1.42–1.44.

Colouration: Upperside dark bronze, lustrous, with a very faint iridescence. Scutellum brown. Underside brown. Femora brown, tibiae dark brown, somewhat brightened anteriorly, tarsi brown. Antennae dark brown to black.

Head: Frons of medium width, somewhat narrower than length of antennomere 3 (like 19 : 21), with very small, indistinct punctures. Genae short, slightly raised, anteriorly terminating somewhat behind the middle part of the fronto-clypeal suture. Fronto-clypeal suture narrowly incised in its whole width, arched. Clypeus stretched forwards, moderately convex longitudinally and transversely, with very small punctures which are the origin of very short recumbent hairs. Mentum trapezoidal, with lustrous, flat, lateral margins, space in between opaque, convex transversely. Underside of neck with medium-sized, very closely set punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Wide, short, not very strongly convex transversely and longitudinally. Sides anteriorly narrowed, bent. Anterior margin excavated. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view continuously visible. Front corners in lateral view rounded, obtuse; hind corners angular, obtuse. Surface with very small, indistinct punctures.

Scutellum: Triangular, impunctate.

Elytra: Widely oval, markedly convex transversely, less convex longitudinally. Maximum height and width somewhat anterior to the middle. Shoulders rounded. Apex of each elytron slightly retracted towards suture. Lateral edges in dorsal view visible in the anterior two-thirds and at the apex. With rows of medium-sized, closely set, deeply depressed punctures which become smaller posteriorly and disappear towards apex; distance between punctures on disc in row 4 slightly less than the diameter of a puncture; about 30 punctures in row 4. Intervals very slightly convex, impunctate.

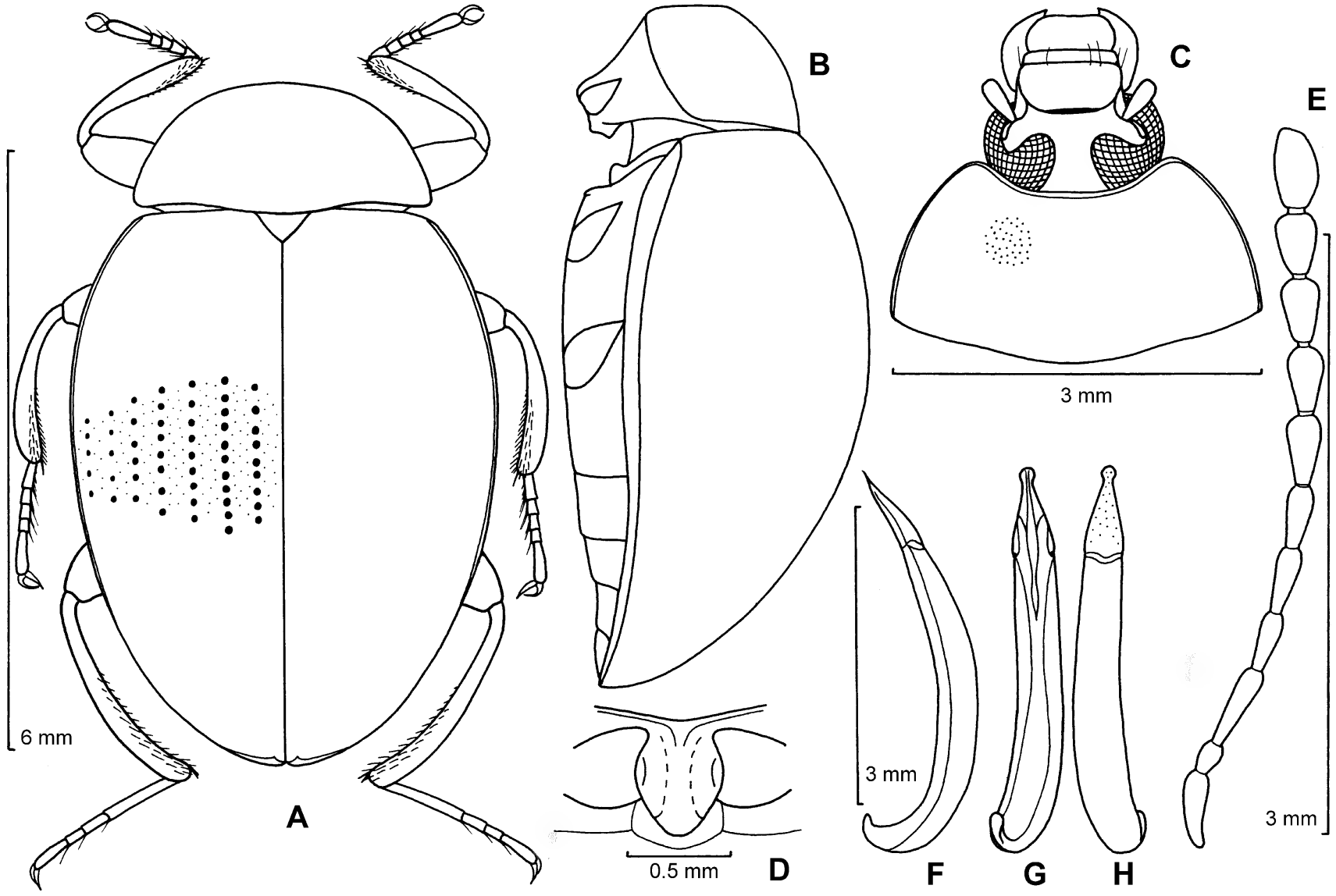


Fig. 35. *Amarygmus medius* n. sp. – **A** Habitus. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

Prosternum: Anterior margin narrowly bent upwards, slightly retracted towards apophysis in its middle. Apophysis elongate oval, lateral margins along procoxae markedly raised, space in between with a deep groove, bottom of this groove opaque.

Mesosternum: Hind part short, wide; anterior margin slightly excavated in its middle, laterally with a bulge.

Metasternum: Anterior margin between mesocoxae rounded, bordered. The partly surrounded apophysis raised like a hump. Anterior part of disc with not very closely set large punctures, posterior part with tiny, widely separated punctures; the punctures are the origin of short, nearly recumbent hairs. Median line shallowly depressed up to the frontal hump.

Sternites: Anterior margin of sternite 1 between metacoxae widely ogival, bordered. Sternites with tiny, widely separated punctures. Sternite 5 apicomedially with a marked depression in males.

Antennae: Antennae reaching to about middle of elytra, slightly shorter in female. Antennomere 11 rounded apically. Length/width ratio of antennomeres 1–11 in male equals to 17:9 / 9:7 / 21:7 / 16:7 / 18:7½ / 17:8 / 19:9 / 19:10 / 18:10 / 18:10 / 22:10.

Legs: Relatively short. Femora thickened towards the second third; back of meso- and metafemora in the basal three-fourths with very short erect hairs in males. Tibiae rather narrow basally, becoming thicker apically; pro- and mesotibiae moderately bent, in males on inner side with a small area of closely set hairs apically; metatibiae slightly bent in the basal two-fifths, strongly incurved apically. Protarsomeres not widened in males. Lengths of protarsomeres 1–5 as 5:6:5:5:22, lengths of mesotarsomeres 1–5 as 15:10:8:7:24, lengths of metatarsomeres 1–4 as 35:14:8:23.

Aedeagus: See Fig. 35F–H.

Amarygmus muluensis **n. sp.**
(Fig. 36A–E)

Holotype (♀): Sarawak, 4th Division, Gn. Mulu NP, P. M. Hammond & J. E. Marshall, V.–VIII.1978, B. M. 1978-49 (BMNH).

Etymology

Muluensis, derived from Mulu, the name of the National Park where this species has been collected.

Diagnosis

Of medium size, elongate oval, markedly convex transversely. Elytral striae with relatively large, rhombic punctures, elytral intervals flat. Frons of medium width, antennae short. Legs short. Upperside dark green, legs dark brown to black.

Amarygmus muluensis n. sp. belongs to a group of species which formerly was assigned to the genus *Elixota*. On Borneo it has to be distinguished from *A. emasensis* n. sp., *A. baluensis* Pic, 1951, and *A. hassalti* Fairmaire, 1882.

A. muluensis and *A. emasensis* have about the same size, but the elytra of *A. muluensis* are shorter (elytral length/width in *A. emasensis* 1.81 : 1), the punctures of the elytral striae larger, the antennae shorter, and the frons wider. The bodies of *A. hassalti* and *A. baluensis* are more voluminous than in *A. muluensis*, the punctures of the elytral striae are much smaller, and the frons is narrower. Males of *A. hassalti* have a swelling on inner side of mesotibiae (males of *A. muluensis* are unknown), and the female mesotibiae of *A. hassalti* are more bent on outer side than in *A. muluensis*.

Description

Measurements: Body length 8.52 mm; body width 4.78 mm. – Ratios: Pronotum: width/length 2.02; width hind corners/width front corners 1.82. Elytra: length/width 1.55; length elytra/length pronotum 3.96; maximum width elytra/maximum width pronotum 1.26.

Colouration: Frons, pronotum, and elytra dark green, slightly lustrous. Underside and legs (including tarsi) dark brown to black. Antennomeres 1–4 dark brown, 4–11 black.

Head: Frons of medium width, wider than length of antennomere 3 (like 24 : 18), densely covered with small punctures. Genae only slightly raised, anteriorly terminating in front of the middle part of the fronto-clypeal suture. Fronto-clypeal suture slightly incised in its middle, not depressed. Clypeus moderately stretched forwards, slightly convex longitudinally, punctures less dense than those of frons. Mentum reversely trapezoidal, lateral margins flat, lustrous, space in between opaque, convex transversely. Underside of neck with medium-sized, closely set punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Relatively wide, moderately convex transversely, slightly convex longitudinally. Widest at base, narrowing towards front corners and bent. Front corners in dorsal view rounded, hind corners angular, obtuse. Anterior margin moderately excavated. Lateral and anterior margins continuously bordered, lateral borders visible in dorsal view. Front and hind corners in lateral view slightly obtuse. Surface with small, distinct, relatively dense punctures.

Scutellum: Triangular, with some tiny punctures.

Elytra: Elongate, slightly oval, convex transversely, less convex longitudinally. Maximum height and width slightly anterior to middle. Shoulders rounded. Apices of elytra mutually rounded. Lateral edges not visible in dorsal view. With slightly incised striae with rhombic, medium-sized punctures which become indistinct and small at the apex of the elytra; about 24 punctures in row 4. Intervals flat, with very tiny, sparse punctures.

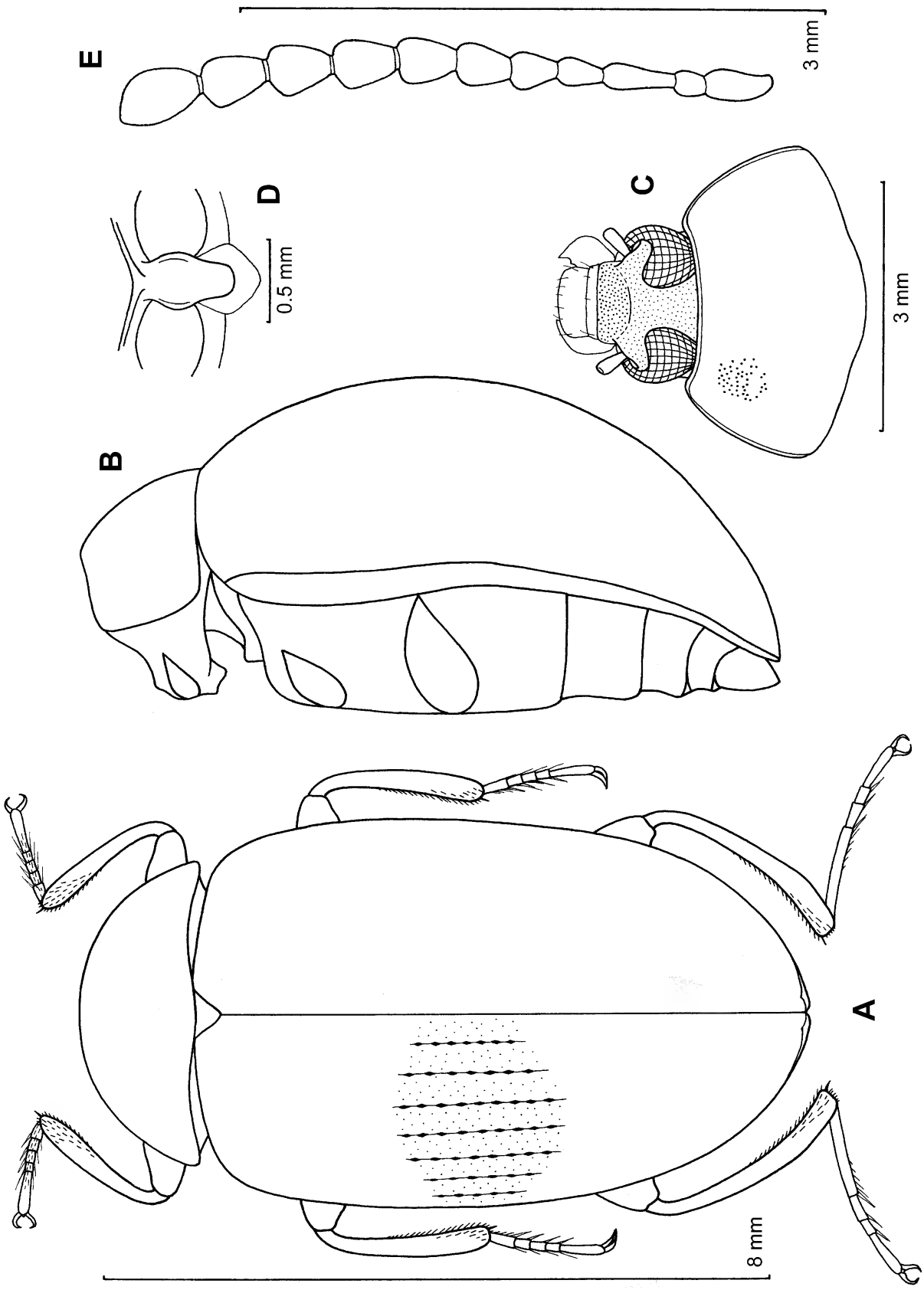


Fig. 36. *Amarygmus muluensis* n. sp. – **A** Habitus, ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna.

Prosternum: Anterior margin narrowly bent upwards laterally, in its middle somewhat broader and slightly retracted towards apophysis. Apophysis not very wide, between anterior margin and area between procoxae somewhat raised, behind coxae descending backwards, margins behind coxae slightly narrowing, margins along coxae widened but only slightly raised, median space in between with a shallow groove; apex rounded.

Mesosternum: Hind part slightly raised; anterior margin deeply excavated in its middle; surface relatively smooth.

Metasternum: Anterior part of disc with some small punctures, posterior part nearly impunctate. Median line markedly depressed on its whole length.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, bordered. Sternites 1 and 2 with indistinct, small punctures and indistinct longitudinal wrinkles. Sternites 3–5 impunctate.

Antennae: Short, reaching to anterior fourth of elytra. Length/width ratio of antennomeres 1–11 equals to 14:8 / 8:7 / 18:7 / 12:8 / 15:11 / 15:13 / 16:14 / 17:14 / 17:14 / 17:14 / 25:14.

Legs: Short. Femora thickened towards the second third. Tibiae thickened apically; protibiae slightly bent, mesotibiae slightly more bent than protibiae, metatibiae clearly bent. Lengths of protarsomeres 1–5 as 7:7:6:6:28, lengths of mesotarsomeres 1–5 as 15:10:8:8:30, lengths of metatarsomeres 1–4 as 48:16:10:28.

Amarygmus murutensis **n. sp.**
(Fig. 37A–H)

Holotype (♂): Borneo, Malaysia, Sabah, Keningau, 300 m, 6.–7.II.2006, R. Grimm (CG).

Paratypes: Same data as holotype (3 ♀♀ CG, 1 ♂ CG, 1 sex not determined CG, 1 ♀ ZSMB, 1 sex not determined ZSMB). – Same data as holotype, but 17.–19.II.2006 (4 sex not determined CG). – Same data as holotype, but 20.–22.III.2007 (2 CG, 1 ZSMB, sex not determined). – Borneo, Sabah W, W of Apin Apin, II.2000, M. Sniżek leg. (1 ♀ ZSMB; without antennae).

Circumstances of collection: On tree bark in parks, at night.

Etymology

Murutensis, derived from Murut, the name of one of the main human tribes of Sabah.

Diagnosis

Small, nearly ovate, elytra markedly convex transversely, shoulders of elytra prominent, pronotum markedly less convex than elytra. Elytra with rows of medium-sized, rather closely set punctures. Pronotum greenish golden, elytra with a copper-coloured disc and green lateral parts, lustrous, colouration especially distinct on pronotum and shoulders of elytra. Frons relatively wide, fronto-clypeal suture deeply depressed, clypeus short. Antennae of medium length, nearly of the same length in both sexes. Upperside of body with very short hairs which become visible at 50–100-fold magnification. Metatarsomere 1 relatively short.

A. murutensis is very similar to *A. expeditus* n. sp., but *A. expeditus* is on average longer (body length 4.01–5.10 mm), the pronotum is markedly wider, the green colouration of the pronotal margins is not encroaching onto elytral shoulders, and the male protibiae have a widening in apical half on inner side.

A. sumatrensis Bremer, 2004 (Bremer 2004e: 123–125) has a similar shape and size, a wide frons and similar rows of elytral punctures as in *A. murutensis*, but *A. sumatrensis* has no greenish colouration on the pronotal and elytral sides, the pronotum is nearly impunctate, the femora and tibiae are reddish brown (blackish brown or black in *A. murutensis*), and the antennae are shorter.

A. snizeki Bremer, 2002 from Sabah (Bremer 2002a: 39) is similar, too. However, *A. murutensis* is somewhat larger (body length of *A. snizeki* 3.35–3.81 mm), the fronto-clypeal suture is depressed, the metatibiae are nearly straight in their basal two-thirds (markedly bent in *A. snizeki*), the antennae are longer, and the elytra are slightly narrower.

Description

Measurements: Body length 3.92–4.16 mm; body width 2.26–2.41 mm. – Ratios: Pronotum: width/length 1.76–1.90; width hind corners/width front corners 1.56–1.61. Elytra: length/width 1.35–1.39; length elytra/length pronotum 3.04–3.24; maximum width elytra/maximum width pronotum 1.25–1.32.

Colouration: Disc of elytra copper-coloured, slightly lustrous; lateral parts of elytra distinctly greenish and more lustrous than disc. Pronotum and head greenish golden and with an iridescence in the colours of light spectrum. Femora blackish brown, tibiae black, tarsi brown. Antennae black. Underside blackish brown.

Head: Frons rather wide, as wide as combined length of antennomeres 3+4, arched towards the depressed fronto-clypeal suture, with small, closely set punctures and tiny hairs originating from most punctures (visible at 100-fold magnification). Genae somewhat raised, anteriorly terminating distinctly in front of the middle part of the fronto-clypeal suture. Clypeus stretched forwards, convex longitudinally, less convex transversely, with small, closely set punctures; the hairs originating from the punctures of the clypeus are somewhat longer than the hairs of the punctures of the frons (well visible at 50-fold magnification). Mentum entirely lustrous, reversely trapezoidal, lateral margins wide, flat, space in between convex. Underside of neck covered with medium-sized, closely set punctures on its anterior part. Outer surface of mandibles with a sulcus, apically bifid.

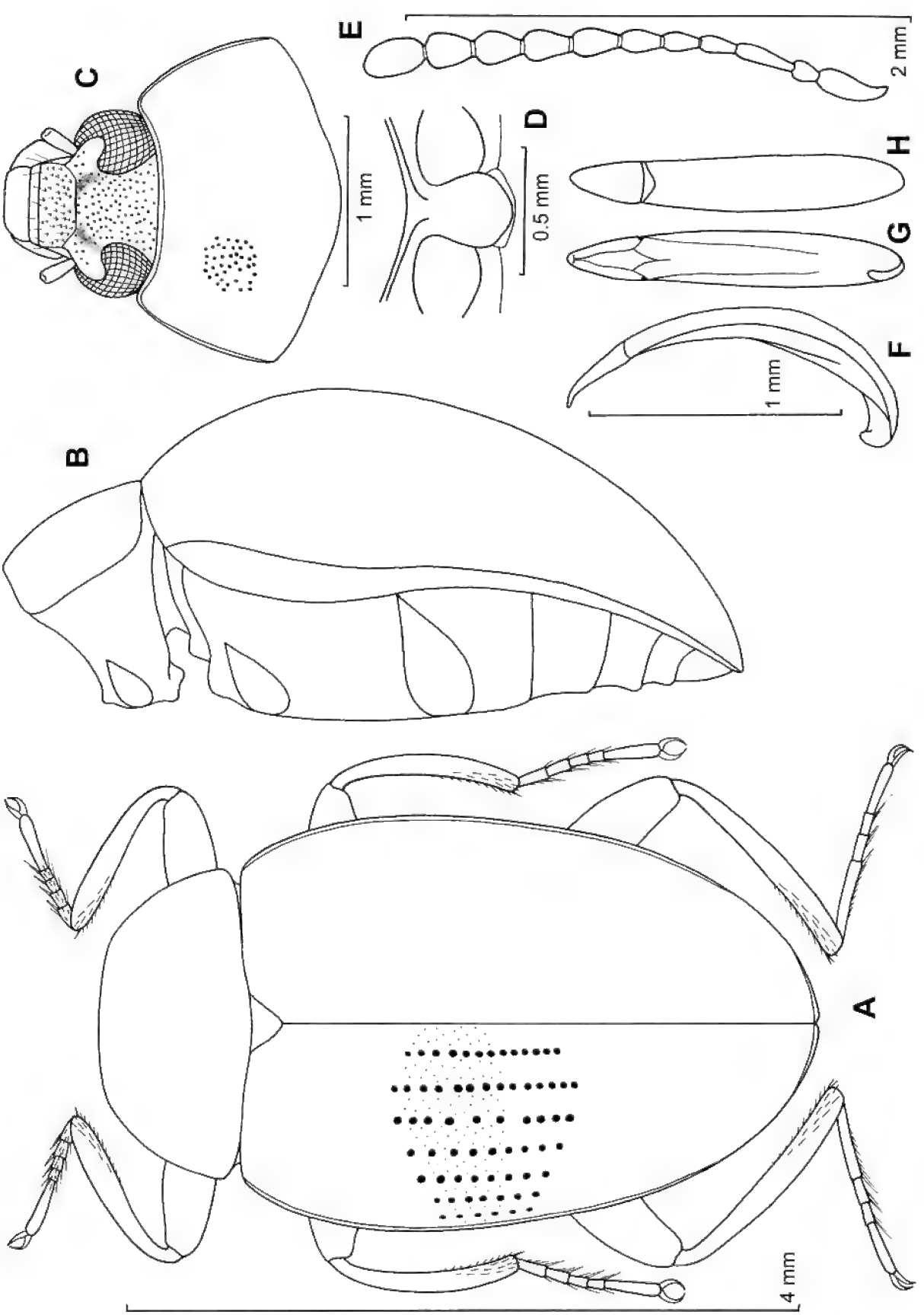


Fig. 37. *Amarygmus murutensis* n. sp. – **A** Habitus. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

Pronotum: Relatively narrow, weakly convex transversely and longitudinally. Widest at base, slightly narrowed and bent anteriorly. Anterior margin excavated. Front corners somewhat pointed and narrowly rounded. Lateral and anterior margins continuously bordered, lateral borders widely visible in dorsal view. Front corners in lateral view angular (angle about 100°), hind corners more obtuse. Surface with small, distinct, irregularly and rather closely set punctures, and a tiny, dust-like pilosity (in old specimens often abraded).

Scutellum: Triangular, with minute punctures.

Elytra: Ovate, markedly convex longitudinally and transversely. Maximum height and width at the level of the anterior third. Shoulders prominent. Apex of each elytron very slightly retracted towards suture. Lateral edges in dorsal view narrowly visible in the anterior four-fifths. With rows of distinct, medium-sized punctures; distance between punctures on disc in row 4 about 1½–2 times diameter of a puncture; punctures becoming small and indistinct towards the apex; about 26 punctures in row 4. Intervals flat on disc, laterally slightly convex, with minute, widely separated punctures.

Prosternum: Anterior margin narrowly bent upwards, retracted towards apophysis in its middle. Apophysis oval, lateral margins only very slightly raised, thus space in between only shallowly depressed; some medium-sized, semi-erect hairs on apophysis.

Mesosternum: Hind part short; anterior margin widely, shallowly excavated in the middle; with some erect hairs.

Metasternum: Anterior margin between mesocoxae rounded, bordered. Anterior part of disc with coarse, closely set punctures and short hairs which originate from these punctures (in both sexes); posterior part with a few tiny punctures. Median line not recognizable.

Sternites: Anterior margin of sternite 1 between metacoxae widely ogival, bordered. Sternite 1 and anterior half of sternite 2 with small, closely set punctures; posterior half of sternite 2 and sternites 3–5 with minute, widely separated punctures. Sternite 5 apicomedially very slightly depressed in males.

Antennae: Not very long, reaching to about anterior third of elytra. Length/width ratio of antennomeres 1–11 equals to 10:5 / 5:4 / 11:3½ / 7:4 / 6:4 / 7:5½ / 9:6 / 9:6½ / 9:6½ / 9:6½ / 13:7.

Legs: Of medium length, rather slender. Femora not markedly thickened. Protibiae nearly straight, mesotibiae slightly bent, metatibiae straight in the basal two-thirds, slightly incurved apically. Protarsomeres not widened in males. Lengths of protarsomeres 1–5 as 4:4:4:4:17, lengths of mesotarsomeres 1–5 as 6:6:5:4:18, lengths of metatarsomeres 1–4 as 19:9:6:17.

Aedeagus: See Fig. 37F–H.

Amarygmus neso **n. sp.**
(Fig. 38A–E)

Holotype (♀): Borneo, Malaysia, Sarawak, Gunung Gading NP, 100–300 m, 23.–29.IX.2008, R. Grimm (CG).

Circumstances of collection: Lowland primary forest, on the bark of a tree, at night.

Etymology

Neso, name of one of the Nereids (according to Hesiod).

Diagnosis

Small, somewhat elongate oval. Elytra with striae with medium-sized, elongate punctures; intervals slightly convex. Frons of medium width, fronto-clypeal suture strongly incised in its middle part, antennae long. Pronotum dark blue, elytra dark coppery, lustrous; legs brown.

Amarygmus neso n. sp. belongs to a group of similar species, but most of them are not known from Borneo. The most similar species on Borneo is *A. praecellens* n. sp. which has the same size and shape and the same colouration of pronotum and elytra as *A. neso*. However, in *A. praecellens* the frons is markedly narrower, the fronto-clypeal suture is scarcely incised (markedly incised in the middle in *A. neso*), and the terminal antennomeres are longer.

Description

Measurements: Body length 5.81 mm; body width 3.35 mm. – Ratios: Pronotum: width/length 1.94; width hind corners/width front corners 1.69. Elytra: length/width 1.35; length elytra/length pronotum 3.41; maximum width elytra/maximum width pronotum 1.30.

Colouration: Frons dark blue, genae brown, clypeus black, lustrous. Pronotum dark blue, lustre reduced. Elytra dark coppery, lustrous. Legs brown. Antennomeres 1–5 brown, 6 dark brown, 7–11 black. Underside brown, lustrous, femora somewhat lighter brown than underside.

Head: Frons of medium width, approximately as wide as length of antennomere 3. Genae raised, anteriorly terminating slightly in front of the middle part of the fronto-clypeal suture. Fronto-clypeal suture distinctly incised in its middle part. Clypeus moderately stretched forwards, somewhat convex transversely, with small punctures which are the origin of very short hairs. Punctures of frons similarly small, without hairs. Mentum widened anteriorly, bent laterally; lateral margins flat, lustrous, space in between somewhat microreticulated and slightly convex transversely. Underside of neck with large, closely set punctures. Outer surface of mandibles with a sulcus; apically bifid.

Pronotum: Wide, uniformly convex transversely, less convex longitudinally. Widest at base, constricted and bent towards front corners. Anterior margin somewhat

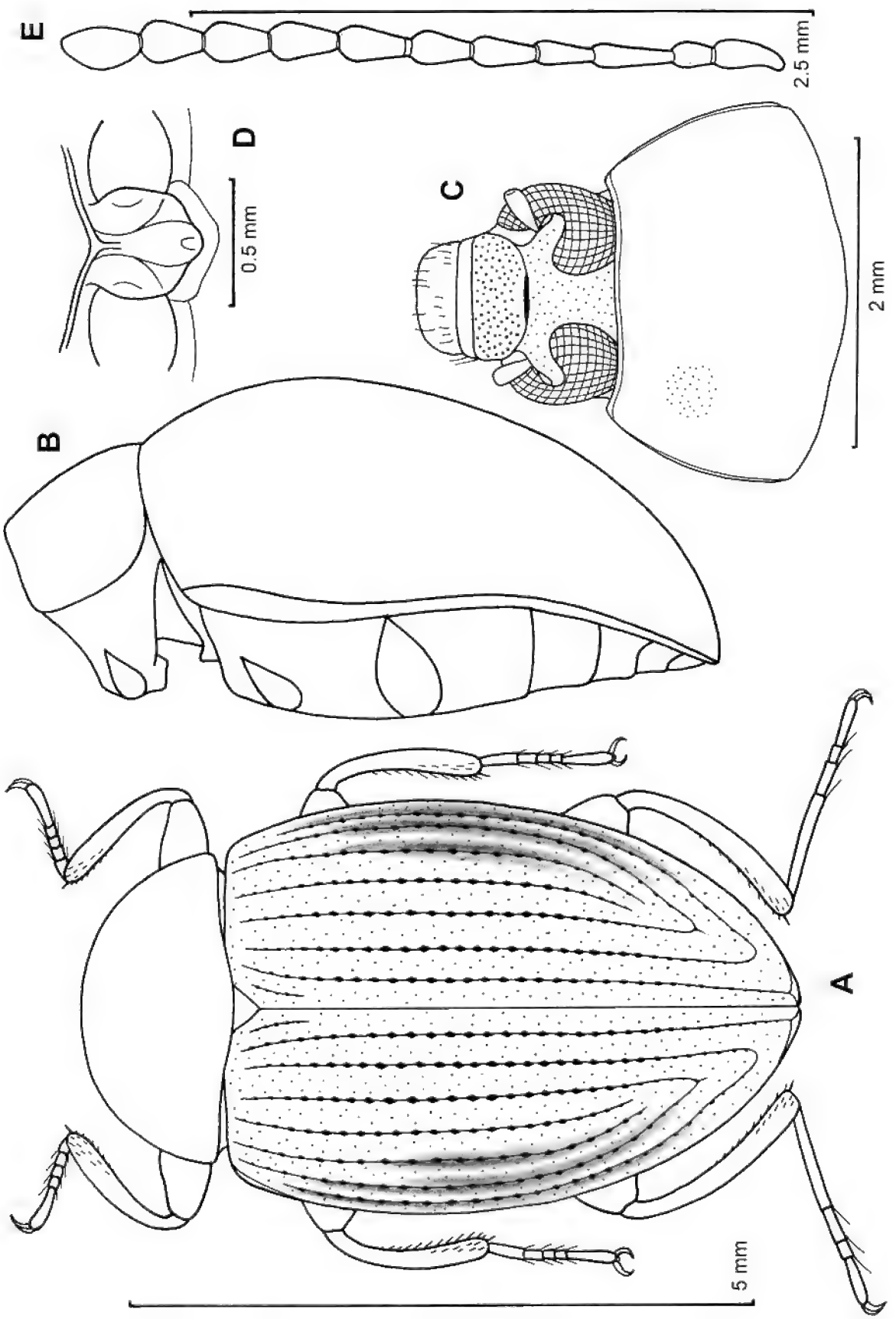


Fig. 38. *Amarygmus neso* n. sp. – **A** Habitus, ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna.

excavated. Front corners in dorsal view nearly rectangular, hind corners obtuse. Lateral and anterior margins bordered. Borders of lateral margins narrowly visible in dorsal view. Front corners in lateral view with an angle of about 100°, hind corners more obtuse. Surface with small, indistinct punctures.

Scutellum: Triangular, impunctate.

Elytra: Oval, slightly elongate, moderately convex transversely, less convex longitudinally. Maximum width and height at the level of the anterior third. Shoulders slightly prominent. Apices of elytra mutually rounded. Lateral edges narrowly visible at the shoulders. With slightly incised and punctured striae; punctures on disc medium-sized and slightly rhombic, punctures becoming smaller posteriorly, changing into incised, nearly impunctated striae apically; about 24 punctures in row 4. Intervals on disc slightly convex, laterally and apically moderately convex, with sparse, tiny punctures.

Prosternum: Anterior margin continuously bent upwards, retracted towards apophysis in its middle, forming an obtuse angle. Apophysis short, wide, lateral margins along coxae widened and slightly raised; space in between with a wide groove; lateral margins posterior to coxae roundedly narrowed; apically slightly protruded in its middle.

Mesosternum: Hind part short, wide; anterior margin slightly excavated in its middle.

Metasternum: Anterior part of disc with some large punctures, posterior part with minute punctures. Median line slightly incised.

Sternites: Discs of sternites with tiny, widely separated punctures and very short recumbent hairs.

Antennae: Long, reaching to middle of elytra. Length/width ratio of antennomeres 1–11 equals to 14:7 / 10:5 / 16:5 / 11:5 / 13:5 / 13:5½ / 13:6½ / 13½:7 / 12½:7 / 11:7 / 14:7½.

Legs: Short. Femora thickened towards the second third. Pro-, meso- and metatibiae moderately bent. Lengths of protarsomeres 1–5 as 4:4:4:3½:17, lengths of mesotarsomeres 1–5 as 15:7:6:6:19, lengths of metatarsomeres 1–4 as 36:14:9:19.

Amarygmus nitens glabratus **n. ssp.**
(Fig. 39A–H)

Holotype (♂): Malaysia, Borneo, Sarawak, nr. Kubah NP, Matang Family Park, 200 m, 7.III.2008, R. Grimm (CG).

Paratypes: Borneo, Malaysia, Sarawak, Gunung Gading NP, 100–300 m, 23.–29.IX.2008, R. Grimm (1 ♀ without antennae CG, 1 ♂ ZSMB). – Borneo, Malaysia, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 10–200 m, Lux, 11.–14.IX.2008, R. Grimm (1 ♀ CG). – Same data as before, but 27.–28.IX.2008 (1 ♀ ZSMB; without antennae). – Borneo, Sarawak, Kubah NP, 200–400 m, 6.–8.III.2008, leg. W. Schawaller (1 ♂ SMNS). – Borneo, Malaysia, Sarawak, Kubah NP, Matang Wildlife Centre vic., 50–100 m, 28.–31.III.2009, R. Grimm (2 ♂♂ CG, 1 ♀ ZSMB). – Borneo, Malaysia, Sarawak, Kuching NP, HQ vic., 100–300 m, 27.–28.III.2009, R. Grimm (1 ♀ CG, 1 sex not determined CG). – Borneo, Malaysia, Sarawak, Kuching, Reservoir Park, 8.IV.2009, R. Grimm (1 ♀ CG).

Circumstances of collection: On tree bark in parks and similar habitats, in part at edge of lowland primary forest, at night; 1 specimen at light.

Etymology

Glabratus (Lat.) = smooth, bald.

Diagnosis

Small, elongate oval. Upperside very brilliant, with strong iridescence on elytra. Elytra with slightly incised striae with medium-sized punctures, intervals slightly convex on disc. Frons of medium width. Antennae long, slightly longer in males than in females. Male protarsomeres 1–3 not widened.

Amarygmus nitens glabratus belongs to a group of species near *A. nitens* Bremer, 2003 s. str., *A. plagiatus* Bremer, 2003, and *A. becvarsenioris* Bremer, 2003 (all described and illustrated in Bremer 2003b). Concerning body shape, size, shape of legs and antennae, the new subspecies is very near to *A. nitens* s. str. from Sumatra, the Mentawei Islands, and the Malayan Peninsula. However, the present taxon from Sarawak shows a somewhat smaller frons and a more distinct elytral iridescence than the material from Sumatra and the Mentawei Islands. I treat the taxon from Sarawak as a subspecies of *A. nitens* because the differences to *A. nitens* s. str. are slight, and the characters of frontal width and iridescence of the specimens from the Malayan Peninsula are intermediate between both taxa.

With respect to colouration, elytral striae and intensity of iridescence *A. nitens glabratus* also resembles *A. plagiatus* from Sumatra, the Malayan Peninsula and Sarawak, but *A. nitens glabratus* is somewhat smaller and narrower, and the punctures of the elytral striae are smaller.

A. becvarsenioris, in contrast to *A. nitens glabratus*, has rows of punctures on the elytra, a wider frons, and is slightly longer; the elytral iridescence is of the same intensity in both taxa.

Description

Measurements: Body length 5.25–5.73 mm; body width 3.00–3.09 mm. – Ratios: Pronotum: width/length 1.93–2.03; width hind corners/width front corners 1.76–1.88. Elytra: length/width 1.49–1.58; length elytra/length pronotum 3.70–4.07; maximum width elytra/maximum width pronotum 1.30–1.33.

Colouration: Upperside brilliant; basic colour of pronotum and elytra dark green, with broad, iridescent ribbons of the spectral colours. Scutellum brown. Head nearly black. Underside brown, lustrous. Femora brown, tibiae dark brown, tarsi brown. Antennomeres 1–4 brown, 6 dark brown, 7–11 black.

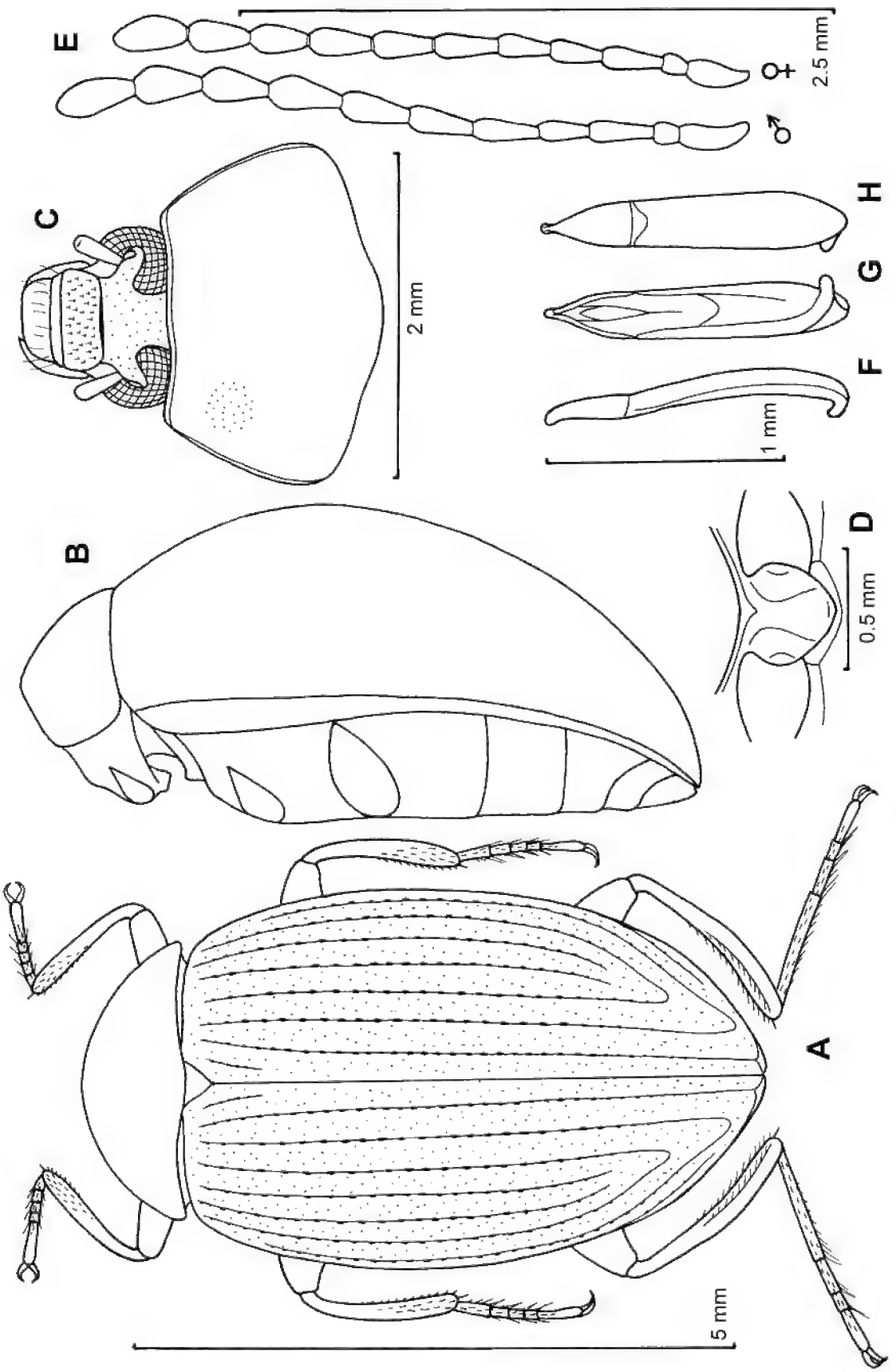


Fig. 39. *Amarygmus nitens glabratus* n. ssp. – **A** Habitus, ♂. **B** Body, lateral view. **C** Head and Pronotum. **D** Prosternal apophysis. **E** Antennae ♂ and ♀. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

H e a d : Frons of medium width, wider than length of antennomere 3 (like 17 : 15). Genae short, slightly raised, anteriorly terminating somewhat behind the middle part of the fronto-clypeal suture. Fronto-clypeal suture markedly depressed and clearly incised in its middle part. Clypeus moderately stretched forwards, longitudinally convex, with medium-sized, closely set punctures; punctures of frons much smaller and less dense than those of clypeus. Mentum reversely trapezoidal. Underside of neck with medium-sized, very closely set punctures. Outer surface of mandibles with a sulcus, apically bifid.

P r o n o t u m : Uniformly convex transversely, less convex longitudinally. Widest at base, narrowing anteriorly, bent. Anterior margin slightly excavated. Front corners not projecting forwards. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view very narrowly visible in their hind half. Front corners in lateral view obtusely angular, hind corners rounded, obtuse. Surface with minute, widely separated punctures.

S c u t e l l u m : Triangular, with some tiny punctures.

E l y t r a : Elongate oval, convex transversely, somewhat less convex longitudinally. Maximum width and height in the middle. Shoulders not prominent. Apices of elytra mutually rounded. Lateral edges not visible in dorsal view. With striae with medium-sized, slightly elongate punctures; distance between punctures on disc in stria 4 about equal to the diameter of a puncture; about 32 punctures in stria 4; punctures smaller near apex; striae slightly incised on disc, somewhat more incised laterally and apically. Intervals slightly convex on disc, somewhat more convex laterally and posteriorly, with very tiny, widely separated punctures.

P r o s t e r n u m : Anterior margin narrowly bent upwards, a short, low keel directed towards apophysis in its median part. Apophysis short, as wide as long; margins raised along procoxae, median space in between with a wide, shallow groove; margins behind coxae roundedly narrowed, apex rounded.

M e s o s t e r n u m : Hind part short, wide; anterior margin slightly excavated in the middle.

M e t a s t e r n u m : Anterior part of disc with a few medium-sized punctures, posterior part impunctate but with some tiny recumbent hairs. Median line slightly incised.

S t e r n i t e s : Sternites 1–3 impunctate, sternites 4 and 5 with a few tiny punctures. Sternite 5 apicomedially without sexual characters in male.

A n t e n n a e : Long, reaching to about middle of elytra. Length/width ratio of antennomeres 1–11 in male equals to 15:5½ / 7:4 / 13:4½ / 10:4½ / 11:5 / 13:6 / 14:6½ / 15:6½ / 15:6½ / 14:6½ / 17:6½.

L e g s : Short. Femora thickened towards the second third. Protibiae nearly straight, mesotibiae somewhat bent, metatibiae more bent than mesotibiae. Mesotibiae on inner side with some semi-erect hairs in the apical half. Lengths of protarsomeres 1–5 as 5:5:5:4:17, lengths of mesotarsomeres 1–5 as 13:9:5:4:18, lengths of metatarsomeres 1–4 as 38:15:6:17.

A e d e a g u s : See Fig. 39F–H.

Amarygmus novior **n. sp.**
(Fig. 40A–I)

H o l o t y p e (♂): Borneo, Malaysia, Sabah, Kinabalu NP, Poring vic., 380 m, 9.–11.III.2007, R. Grimm (CG).

P a r a t y p e s : Same data as holotype (3 ♂♂ CG, 1 ♂ ZSMB, 1 ♀ CG, 2 ♀♀ ZSMB). – Borneo, Sabah, Crocker Range NP, NW Keningau, 900–1200 m, 16.–20.XI.1996, leg. W. Schawaller (1 ♂ SMNS).

Circumstances of collection: Edge of lowland primary forest, on tree bark, at night (in Kinabalu NP).

Etymology

Novior (Lat.), comparative of novus = new.

Diagnosis

Small to medium-sized, oval. Upperside green, legs brown. Elytra with striae with punctures and slightly convex intervals. Frons not very wide. Antennae of medium length. Males are characterized by long hairs on front of profemora, on back of mesofemora and on prosternal apophysis.

Because of the male sexual characters (long hairs on femora and prosternal apophysis) *A. novior* belongs to a species group near *A. postdepressus* Pic, 1938 (redescribed in Bremer 2004a: 29–31, fig. 16). On Borneo, this group includes also *A. dignus* Bremer, 2004, *A. crockeri* Bremer, 2004 (see Bremer 2004e: 111–116), and *A. disgregatus* n. sp.

A. postdepressus, *A. crockeri*, and *A. disgregatus* have striae on the elytra as in *A. novior* n. sp.; *A. dignus* has rows of punctures. *A. disgregatus* can be separated from *A. novior* by its colouration (blue or violet pronotum and blue or violet elytral shoulders) and the somewhat narrower frons.

In contrast to *A. novior* (and *A. disgregatus*), *A. postdepressus* and *A. crockeri* do not show light brown legs. Moreover, *A. crockeri* is larger than *A. novior* (body length of *A. crockeri* 7.01–7.64 mm, elytral length/width 1.34–1.42:1), the upperside is copper-coloured, femora and tibiae are blackish, and this species is probably restricted to high altitutes of the Crocker Mountains of Sabah.

A. postdepressus is similarly large as *A. novior* (body length of *A. postdepressus* 6.45–7.80 mm, elytral length/width 1.26–1.33 : 1), but differs in its colouration (lustrous, dark coppery upperside with distinct, colourful, transverse reflections on elytra, blackish brown tibiae which are somewhat brightened apically in some specimens) and in the markedly shorter antennae of the females.

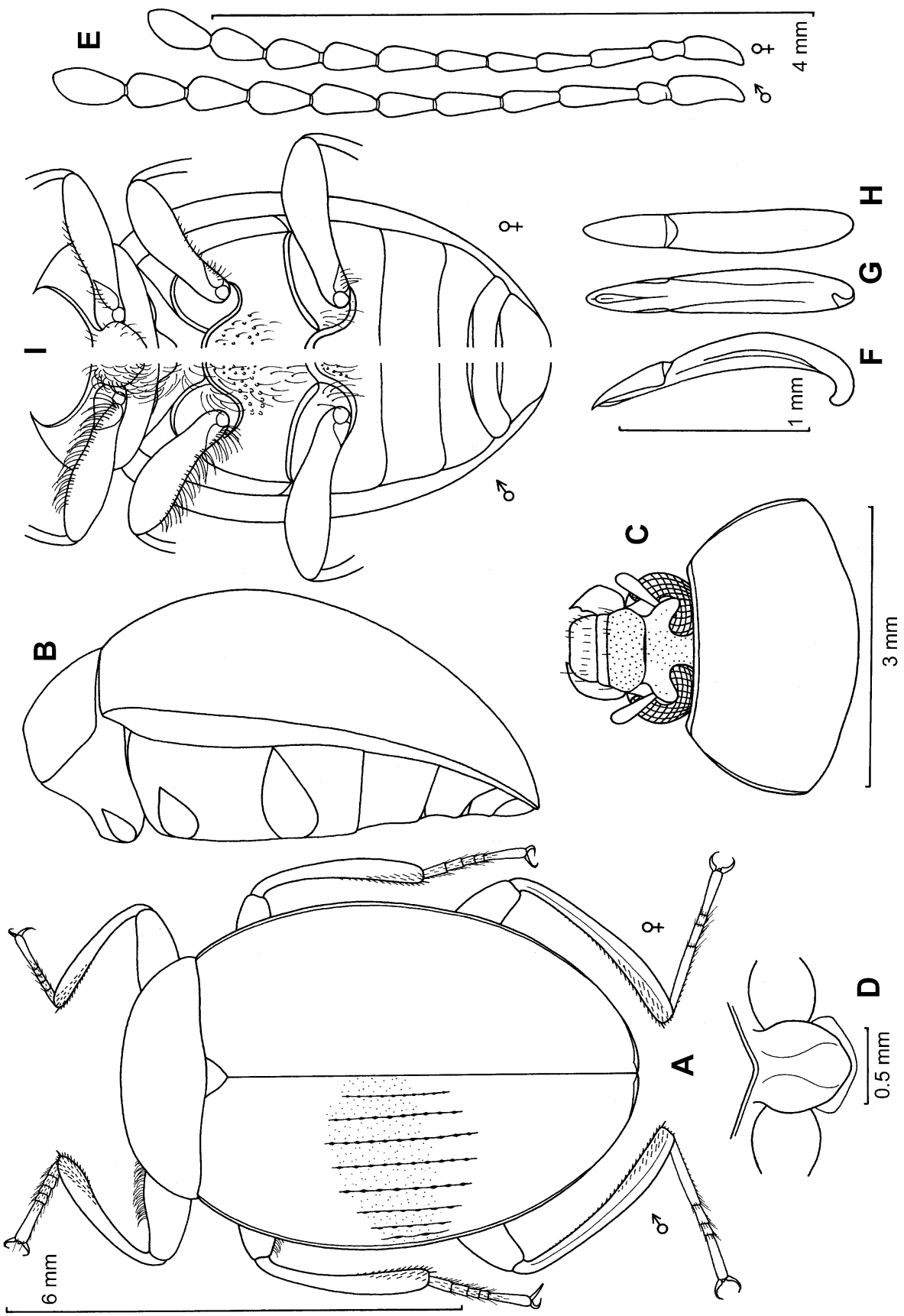


Fig. 40. *Amarygmus novior* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antennae ♂ and ♀. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view. **I** Body, ventral view; left side ♂; right side ♀.

Description

Measurements: Body length 5.72–7.01 mm; body width 3.66–4.46 mm. – Ratios: Pronotum: width/length 1.94–2.00; width hind corners/width front corners 1.75–1.83. Elytra: length/width 1.27–1.35; length elytra/length pronotum 3.61–3.88; maximum width elytra/maximum width pronotum 1.42–1.46.

Colouration: Upperside green, slightly lustrous (pronotum more intensively green than elytra). Frons green, clypeus black. Underside brown. Femora and tibiae somewhat lighter brown than underside. Antennomeres 1–7 brown, 8–11 black.

Head: Frons somewhat narrower than length of antennomere 4 (like 17 : 19). Genae somewhat raised, narrow, anteriorly terminating at the level of the middle part of the fronto-clypeal suture. Fronto-clypeal suture markedly incised in the middle, less incised in its lateral parts. Clypeus stretched forwards, slightly convex longitudinally and transversely, with small, distinct punctures which are the origin of short, semi-erect hairs. Punctures of frons markedly smaller than those of clypeus. Mentum reversely trapezoidal, lateral margins wide, flat, lustrous, space in between opaque and somewhat convex transversely. Underside of neck strongly microreticulated, anteriorly with small, closely set, transversely mostly aligned punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Relatively short, convex transversely, slightly convex longitudinally. Lateral margins narrowing anteriorly, bent; maximum width usually at the hind corners, in some specimens just in front of them. Front corners in dorsal view narrowly rounded. Anterior margin slightly excavated. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view visible. Front and hind corners in lateral view rounded, obtuse. Surface with minute, moderately densely and irregularly set punctures.

Scutellum: Triangular, impunctate.

Elytra: Compact, oval, markedly convex transversely, somewhat less convex longitudinally. Maximum width and height shortly anterior to middle, narrowed towards shoulders. Apices of elytra mutually rounded. Lateral edges in dorsal view narrowly visible, except on shoulders and on apex. With somewhat incised striae with medium-sized, elongate punctures which become markedly smaller near apex of the elytra; distance between punctures on disc 1–2 times diameter of a puncture; about 25 punctures in stria 4. Intervals flat laterally and on disc, with very small, distinct, moderately closely set punctures.

Prosternum: Anterior margin continuously and narrowly bent upwards, retracted towards apophysis in the middle, forming an obtuse angle. Apophysis rather wide; widened and raised along coxal margins, space in between with a wide groove; posterior to coxae somewhat projecting backwards with narrowing sides, apically broadly pointed; apophysis in females with a few irregularly set, erect, tender hairs, in males with very dense, very long hairs which hide the surface of the apophysis.

Mesosternum: Wide, short. Pilosity like that of the prosternal apophysis in both sexes.

Metasternum: Anterior margin between mesocoxae rounded, coarsely bordered. Anterior apophysis behind anterior margin somewhat separated from disc. Apophysis and anterior part of disc with coarse, not very closely set punctures. Posterior part of disc with very small punctures. Very long and thick hairs hide the disc in males; in females these hairs are short, semi-erect and do not hide the metasternal surface. Median line scarcely incised.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, bordered. All sternites with scarcely visible punctures and very short recumbent hairs in both sexes. Sternite 5 apicomedially without depression in males.

Antennae: Antennae reaching to anterior third of elytra. Antennomere 11 spindle-shaped. Length/width ratio of antennomeres 1–11 in male equals to 26:9 / 9:7 / 26:8 / 19:8 / 21:8 / 19:8 / 22:10½ / 21:11 / 21:11 / 20:11 / 24:11.

Legs: Of medium length. Femora thickened towards the second third; back of mesofemora in males somewhat excavated in the basal two-thirds. males with long hairs on protrochanters, anterior basal two-thirds of profemora, posterior basal four-fifths of mesofemora (in two rows of hairs), and on mesotrochanters. Metafemora bare in both sexes. Protibiae slightly bent, thickened apically; mesotibiae bent in males, nearly straight in females. Metatibiae slender, in males somewhat longer than in females; in males markedly bent and in the apical two-thirds on inner side with small tubercles which are the origin of short bristles; in females in the basal half approximately straight, in the apical half somewhat incurved, but without tubercles. Protarsomeres not widened in males. Lengths of protarsomeres 1–5 as 7:7:6:5:30, lengths of mesotarsomeres 1–5 as 14:9:7:6:29, lengths of metatarsomeres 1–4 as 39:14:8:30.

Aedeagus: See Fig. 40F–H.

Amarygmus nuntius **n. sp.**
(Fig. 41A–I)

Holotype (♂): Singapore, Dr. Will (ZMHB).

Paratypes: Same data as holotype (1 ♂ ZMHB). – Malaysia, Borneo, Sarawak, NW Kuching, Matang Wildlife Centre, 50–100 m, 16.–17.III.2008, R. Grimm (1 ♀ CG, 1 ♀ ZSMB). – Sarawak, Matang, leg. Xántus (1 ♂ HNHM).

Circumstances of collection: Lowland primary forest (at Matang Wildlife Centre), on tree bark, at night.

Etymology

Nuntius (Lat.) = messenger.

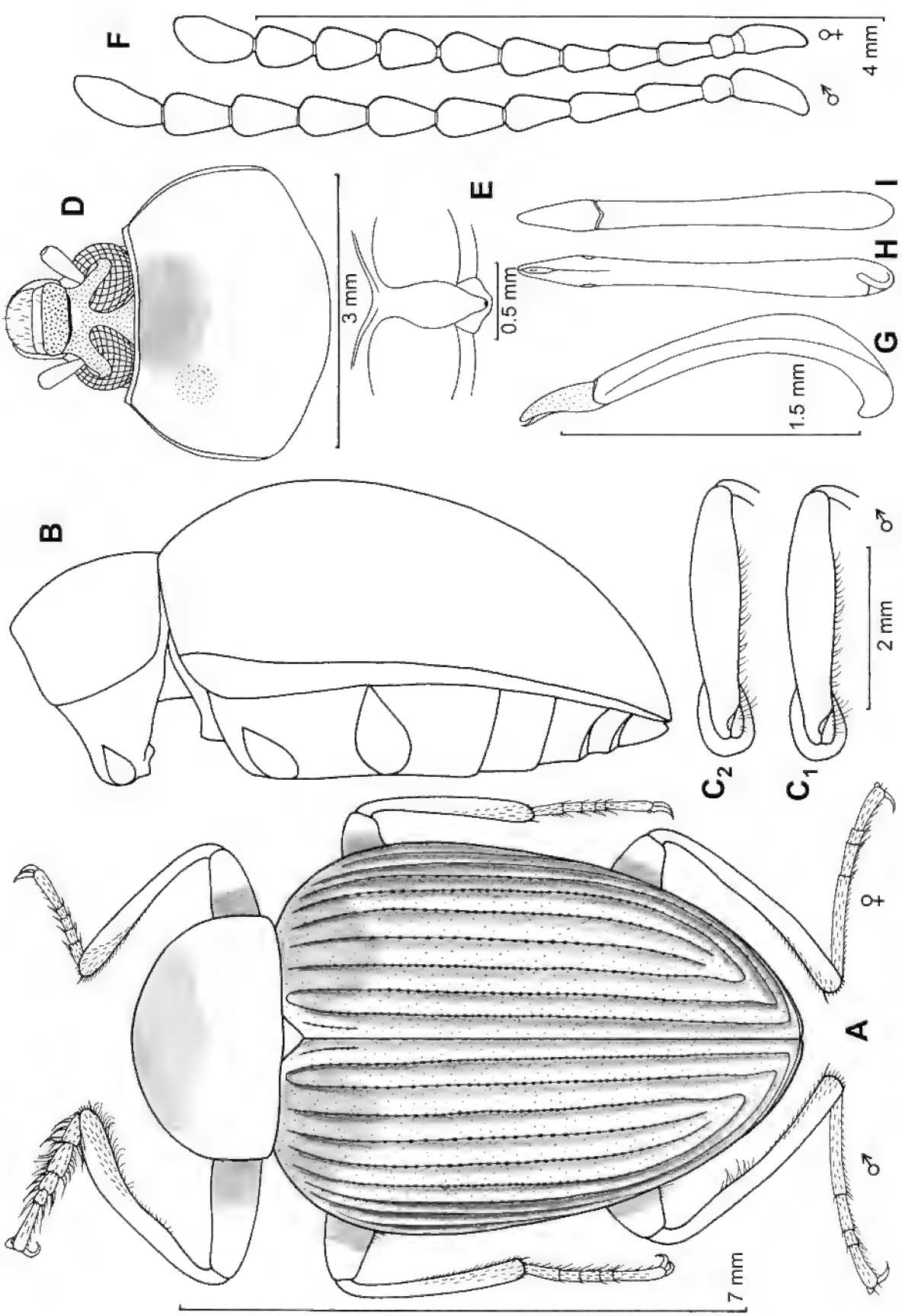


Fig. 41. *Amarygmus nuntius* n. sp. – **A** Habitus (shaded area of pronotum and darker shaded area anteriorly on elytra reddish brown); legs on left side ♂, right side ♀. **B** Body, lateral view. **C_1** Metafemur ♂, **C_2** Mesofemur ♂. **D** Head and pronotum. **E** Prosternal apophysis. **F** Antennae ♂ and ♀. **G** Aedeagus, lateral view. **H** Aedeagus, ventral view. **I** Aedeagus, dorsal view.

Diagnosis

Of medium size, oval, markedly convex. Pronotum and elytra with reddish brown maculae on black ground (Fig. 41A). Frons relatively narrow. Antennae of medium length, in males longer than in females, antennomeres 6–10 nearly triangular. Males with prolonged forelegs and widened protarsomeres 1–3.

A. proteus n. sp. from Sarawak and Singapore has about the same shape and nearly the same pattern of maculae on pronotum and elytra. *A. nuntius* differs from *A. proteus* in the more flattened and triangular antennomeres 6–10 (elongate and approximately cylindrical in *A. proteus*), the black antennomere 11 (reddish brown in *A. proteus*), and the shape of the aedeagus which is similar to *A. rufonotatus* Pic, 1915 (similar to *A. furvus* (Gebien, 1927) in *A. proteus*).

Description

Measurements: Body length 6.93–8.28 mm; body width 3.90–4.22 mm. – Ratios: Pronotum: width/length 1.55–1.67; width hind corners/width front corners 1.71–1.90. Elytra: length/width 1.45–1.56; length elytra/length pronotum 3.09–3.17; maximum width elytra/maximum width pronotum 1.29–1.30.

Colouration: Upperside mostly black, slightly lustrous; front part of pronotum reddish brown (extension of the reddish brown part varying individually, compare Fig. 41A, 41D), anterior part of elytra next to base similarly reddish brown (separated from each other by the black scutellum and the black interval 1). Underside black, lustrous. Femora reddish brown with a black cap apically, tibiae black, tarsomeres either black or brown.

Head: Frons relatively narrow, as wide as length of antennomere 2, situated somewhat higher than the adjacent eyes. Genae short, slightly convex, anteriorly terminating a little in front of the level of the fronto-clypeal suture. Eyes large, circumventing the genae and the root of the antennae. Fronto-clypeal suture markedly depressed and incised. Clypeus short, convex transversely, situated lower than the frons. Clypeus and frons with closely set punctures; punctures on clypeus larger than those on frons. Mentum with rounded sides, lateral margins flat, impunctate, brilliant, space in between densely punctated and with long, tender hairs. Underside of neck with small punctures. Outer surface of mandibles with a longitudinal sulcus, apically bifid.

Pronotum: Not very wide; markedly convex transversely, also convex longitudinally but less so than transversely. Lateral margins narrowing in the anterior half, subparallel in the posterior half. Front corners in dorsal view angular, obtuse. Anterior margin slightly excavated. Lateral margins and anterior margin continuously bordered. Lateral borders in dorsal view narrowly visible. Front corners in lateral view rounded, obtuse; hind corners angular, obtuse. Surface with small, indistinct punctures.

Scutellum: Triangular, sides slightly bent.

Elytra: Elongate oval, markedly convex transversely, somewhat less convex longitudinally. Maximum height and width at the level of the anterior third. Shoulders prominent. Apices of elytra mutually rounded. Lateral edges narrowly visible in the anterior two-thirds. With moderately incised striae with very small, elongate punctures. Intervals slightly convex on disc, markedly convex laterally, with indistinct, tiny punctures.

Prosternum: Anterior margin narrowly bent upwards, except in the middle. Apophysis narrow, spindle-like, on its anterior part rising towards coxae, behind coxae descending to an acutely pointed apex; median space between coxae not depressed; with some tender, irregularly placed hairs.

Mesosternum: Hind part somewhat higher ventrad than metasternum, with subparallel sides; anterior margin markedly excavated in the middle.

Metasternum: Disc in males with small, sparse punctures with long recumbent hairs, in females with smaller punctures with much shorter hairs. Median line incised.

Sternites: Discs of sternites with sparse, small punctures and medium-sized, semi-erect, tender hairs. Sternite 5 apicomedially not depressed.

Antennae: Of medium length, in males longer than in females (but incomplete in males). Length/width ratio of antennomeres 1–11 in female equals to 20:10 / 9:8 / 16:8½ / 17:8½ / 16:9 / 20:13 / 20:13 / 20:13 / 20:13½ / 19:13½ / 26:10.

Legs: Of medium length. Forelegs in males markedly prolonged, middle and hind legs slightly prolonged. Femora thickened towards the second third. Meso- and metafemora in males with long, tender hairs posteriorly. Protibiae in males in the basal half straight and gradually thickened, in the apical half incurved, markedly thickened, excavated and with erect hairs on inner side; protibiae in females nearly straight. Mesotibiae slightly bent in both sexes. Metatibiae nearly straight in the posterior half, incurved and thickened in the basal half; in males with long, erect, tender hairs in the middle on inner side. Protarsomeres 1–4 in males with long, laterally erect hairs, protarsomeres 1–3 prolonged and widened. Lengths of protarsomeres 1–5 in male as 17:14:8:6:35, lengths of mesotarsomeres 1–5 as 23:14:11:9:36, lengths of metatarsomeres 1–4 as 57:14:8:34; in female the corresponding lengths are 10:10:8:8:30, 18:12:9:7:31, and 50:16:9:31.

Aedeagus: See Fig. 41G–I.

Amarygmus nyctelius **n. sp.**
(Fig. 42A–H)

Holotype (♂): Borneo, Malaysia, Sabah, Kinabalu NP, HQ vic., 1550 m, 11.–13.II.2006, R. Grimm (CG).

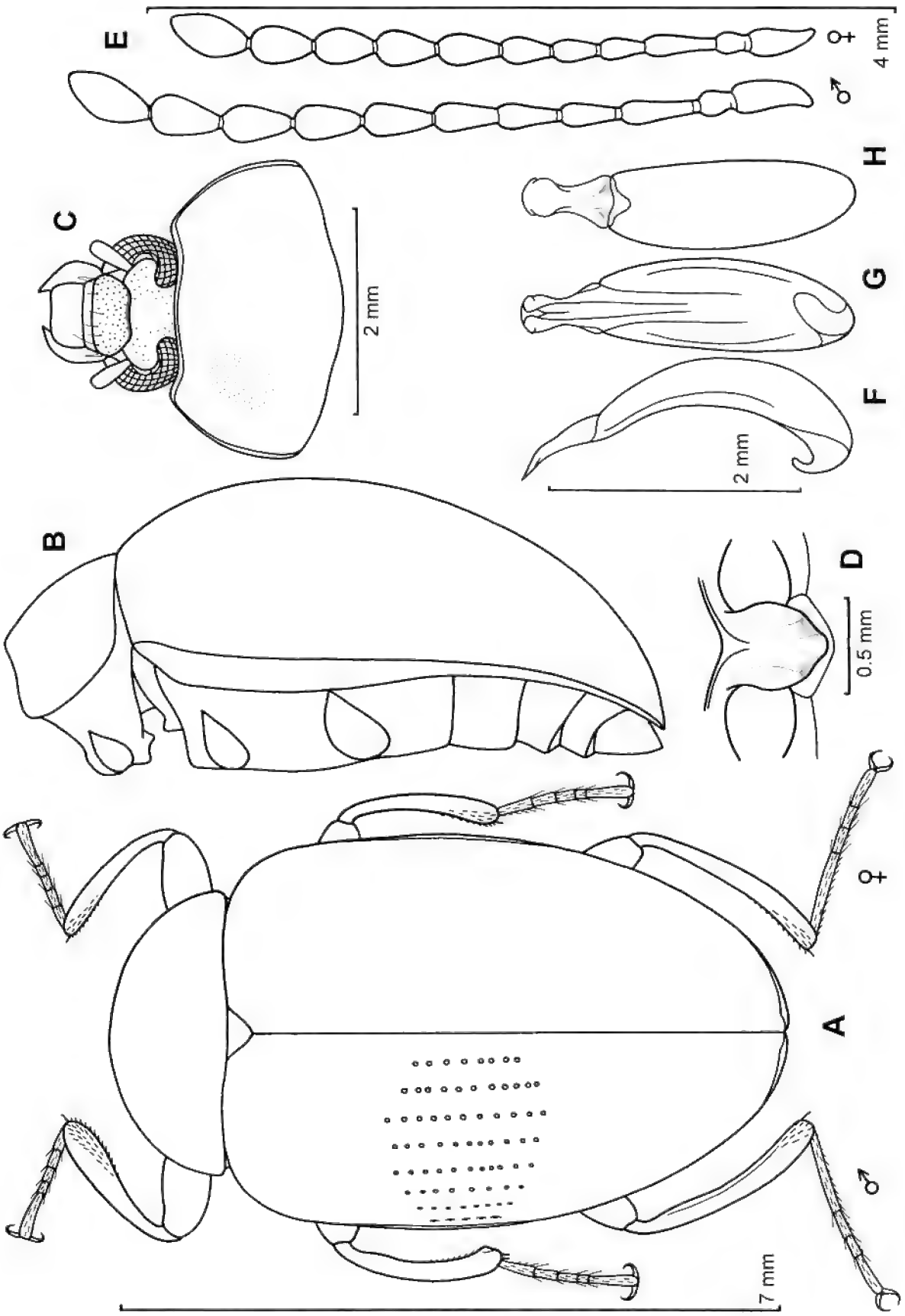


Fig. 42. *Amarygmus nyctelius* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antennae ♂ and ♀. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

Paratype: Same data as holotype (1 ♀ ZSMB).

Circumstances of collection: Edge of mountainous primary forest, on the bark of a tree, at night.

Etymology

Nyctelius (Lat.), epithet = at night.

Diagnosis

Of medium size, elongate oval, not very strongly convex, with the maximum width at the anterior fourth of elytra, lustrous. Elytra with rows of medium-sized punctures which are separated by a narrow distance; intervals flat, with minute, indistinct punctures. Frons of medium width, fronto-clypeal suture strongly depressed and incised, antennae of medium length. Meso- and metatibiae markedly bent; male protibiae widened in apical half on inner side; male mesotibiae with a tubercle-like bulge anterior to apex on inner side; male protarsomeres 1–3 not widened.

A. nyctelius resembles *A. dignus* Bremer, 2004 (Bremer 2004e: 113–116) from Sabah. However, *A. dignus* is somewhat larger than *A. nyctelius*, the males have long hairs on pro- and mesofemora, no widening in the apical half on inner side of protibiae, and the aedeagi are different.

Description

Measurements: Body length 7.01+7.05 mm; body width 3.90+3.94 mm. – Ratios: Pronotum: width/length 1.89+1.92; width hind corners/width front corners 1.78+1.85. Elytra: length/width 1.49+1.51; length elytra/length pronotum 3.89+4.00; maximum width elytra/maximum width pronotum 1.38+1.39.

Colouration: Upperside markedly lustrous, coppery. Frons somewhat microreticulated, therefore, less lustrous than pronotum. Clypeus black. Underside dark brown. Femora and tibiae black, tarsi brown. Antennomeres 1–3 dark brown, 4–11 black.

Head: Frons of medium width, as wide as combined length of antennomeres 2+3. Genae somewhat raised, anteriorly terminating slightly in front of the middle part of the fronto-clypeal suture. Fronto-clypeal suture widely depressed in its middle part and somewhat incised. Clypeus slightly stretched forwards, convex longitudinally, slightly convex transversely, with small, rather closely set punctures; frons with markedly smaller and sparser punctures than those on clypeus. Mentum lustrous, widened anteriorly, with rounded sides and flat lateral margins, space between lateral margins convex. Underside of neck with small, very closely set punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Wide, convex transversely and longitudinally. Widest at base, anteriorly narrowing and bent. Hind corners in dorsal view angular, obtuse, front corners narrowly rounded. Anterior margin slightly excavated. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view visible over their whole length. Front and hind corners in lateral view angular, obtuse. Surface with small, distinct, irregularly set punctures.

Scutellum: Triangular, impunctate.

Elytra: Elongate oval, moderately convex. Maximum width and height approximately at the level of the anterior fourth. Shoulders prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view visible only near the shoulders. With rows of medium-sized, distinct punctures which become indistinct in the apical eighth of the elytra; distance between punctures on disc in row 4 about 1–2 times diameter of a puncture; about 35 punctures in row 4. Intervals flat, with tiny, sparse punctures which are visible at 25-fold magnification.

Prosternum: Anterior margin narrowly bent upwards, interrupted in the middle, where a flat keel is originating, extending across the whole apophysis. Apophysis widened, lateral margins raised along procoxae, space in between with a wide, shallow groove; sides posterior to coxae roundedly narrowed, continuing into a rounded apex; the keel extending across the apophysis somewhat lifted apicomedially.

Mesosternum: Short, wide. Anterior margin moderately excavated in the middle; hind part very shallowly sulcated laterally.

Metasternum: Anterior part of disc with coarse, closely set punctures, posterior part with sparse, tiny punctures. Median line slightly incised.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, narrowly bordered. Anterior part of sternite 1 with very small punctures, posterior part of sternite 1 and subsequent sternites impunctate. Sternite 5 apicomedially very deeply depressed in males.

Antennae: Of medium length (same length in both sexes), reaching to anterior third of elytra. Length/width ratio of antennomeres 1–11 equals to 21:7½ / 8:6½ / 20:7 / 15:7 / 15:7 / 15:7½ / 17:8 / 16:8 / 15:8 / 15:8 / 20:8.

Legs: Short. Femora thickened towards the second third. Protibiae in males slightly bent on outer side, apical two-thirds strongly widened on inner side, with short, dense hairs on the widening; in females slightly but uniformly bent on outer side, only slightly widened on inner side. Mesotibiae markedly bent in both sexes, in males flattened on inner side on apical two-thirds, the flattened area terminating in a protruding tubercle near apex; in females neither flattened area nor tubercle. Metatibiae markedly bent in both sexes. Lengths of protarsomeres 1–5 as 9:8:7:6:26, lengths of mesotarsomeres 1–5 as 16:11:8:7:27, lengths of metatarsomeres 1–4 as 33:13:9:27.

Aedeagus: See Fig. 42F–H.

Amarygmus platypodes **n. sp.**
(Fig. 43A–I)

Holotype (♂): Borneo, Malaysia, Sabah, Crocker Range, Gunung Emas, 1500 m, 16.–21.III.2007, R. GRIMM (CG).

Paratype: Same data as holotype (1 ♀ ZSMB).

Circumstances of collection: Mountainous primary forest, on tree bark, at night.

Etymology

Platypodes, from Greek τό πλάτ·ός = width, and ό πούς = leg, foot.

Diagnosis

Small, slightly elongate oval. Elytra copper-coloured, lustrous, pronotum with a golden tinge. Elytra with rows of medium-sized, distinct punctures, and with flat, nearly impunctate intervals. Frons of medium width, antennae of medium length, in male somewhat longer than in female. Male protibiae strongly and increasingly widened from base to apex with nearly even margins; male mesotibiae distinctly widened and hollowed on underside; female protibiae less widened and mesotibiae not hollowed on underside. Male protarsomeres 1–3 not widened.

On the Greater Sunda Islands there are several species with a widening of male protibiae in the apical half on inner side. However, I only know *A. platypodes* which has a uniform widening from base to apex.

A. platypodes resembles in size and shape *A. catenatus* n. sp., thus female specimens of both species can only be identified by slight differences in the inner side of the protibiae.

Description

Measurements: Body length 5.42+5.49 mm; body width 3.18+3.21 mm. – Ratios: Pronotum: width/length 1.74+1.79; width hind corners/width front corners 1.82+1.82. Elytra: length/width 1.36+1.38; length elytra/length pronotum 3.33+3.35; maximum width elytra/maximum width pronotum 1.36+1.40.

Colouration: Elytra copper-coloured, lustrous. Pronotum with a golden tinge. Head black, microreticulated, slightly lustrous. Scutellum brown. Femora and tibiae black, tarsi reddish brown. Antennomeres 1–5 dark brown, 6–11 black. Underside blackish brown (except metasternum which may be entirely or partially reddish brown).

Head: Frons of medium width, approximately as wide as length of antennomere 3. Genae slightly raised, anteriorly terminating approximately at the level of the middle part of the fronto-clypeal suture. Fronto-clypeal suture depressed and incised in its middle part. Clypeus moderately stretched forwards, insignificantly convex longitudinally, nearly flat transversely, only the lateral margins bent downwards. Clypeus with small, rather closely set punctures, punctures on frons and genae more widely separated; very short hairs originating from the punctures of clypeus and genae. Mentum wide, reversely trapezoidal, with flat, wide sides, space in between slightly convex and with some small punctures. Underside of neck with coarse, rhombic, transversely aligned punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Of medium width, markedly and uniformly convex transversely, less convex longitudinally. Lateral margins anteriorly narrowing. Hind corners obtuse, front corners in dorsal view approximately rectangular. Anterior margin distinctly excavated. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view narrowly visible in the posterior three-fourths. Front corners in lateral view rectangular, hind corners obtuse. Surface with small, irregularly set punctures.

Scutellum: Triangular, impunctate.

Elytra: Very slightly elongate oval, strongly convex transversely, somewhat less convex longitudinally. Maximum width and height slightly behind level of the anterior third. Shoulders prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view narrowly visible in and behind the middle. With rows of medium-sized punctures which become increasingly smaller posteriorly and disappear near apex; distance between punctures on disc in row 4 about 1½–2 times diameter of a puncture; about 38 punctures in row 4. Intervals flat, with tiny, widely separated punctures.

Prosternum: Anterior margin narrowly bent upwards, retracted towards apophysis in the middle and forming a low keel which extends across the whole apophysis and becomes wider posteriorly. Lateral margins somewhat widened and raised along procoxae, space in between with a shallow groove. Apophysis posterior to the coxae shortly projecting to the back with subparallel sides, apically broadly pointed.

Mesosternum: Anterior margin excavated in the middle, posterior to excavation somewhat depressed and surface smooth; lateral margins wrinkly.

Metasternum: Anterior margin between mesocoxae rounded, broadly bordered. Anterior apophysis raised like a swelling, reddish brown, with smooth surface. Disc with 2–3 transverse rows of medium-sized punctures posterior to the lateral part of the anterior margin and posterior to the apophysis, the remaining part of the disc with a few tiny punctures. Median line incised from the back up to the apophysis.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, coarsely bordered. Sternites with a few tiny, indistinct punctures. Sternite 5 apicomedially slightly depressed in male.

Antennae: Antennae reaching to anterior fourth of elytra. Length/width ratio of antennomeres 1–11 in male equals to 13:6 / 8:5½ / 16:5½ / 12:5½ / 12:6 / 11:6½ / 12:7 / 14:7½ / 14:7½ / 14:7½ / 16:8, in female to 11:7 / 7:5½ / 16:5 / 10:5 / 11:5½ / 11:6½ / 11:8 / 12:8½ / 12:8½ / 11½:9 / 15:9.

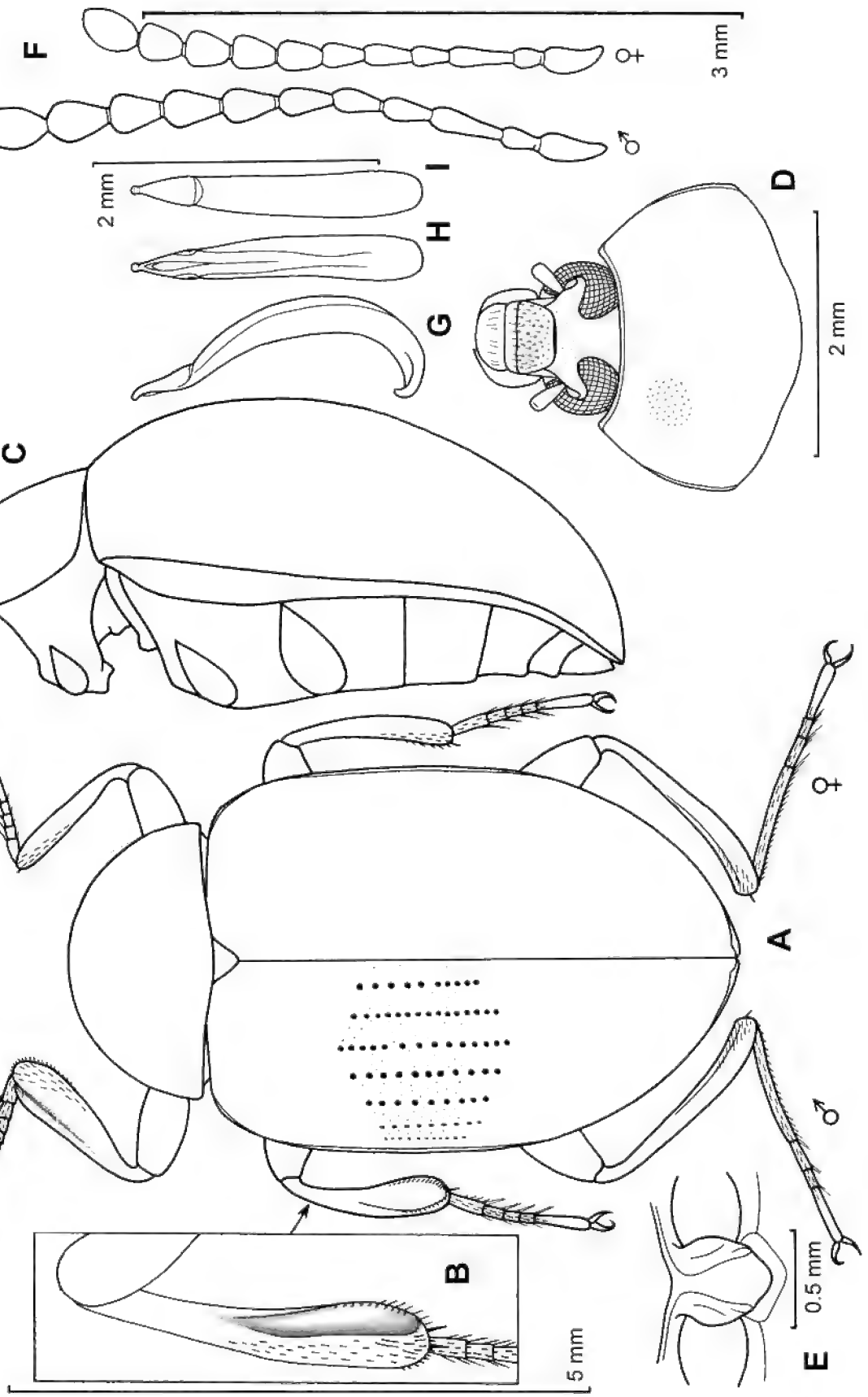


Fig. 43. *Amarygmus platypodes* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Underside of mesotibiae, depressed area. **C** Body, lateral view. **D** Head and pronotum. **E** Prosternal apophysis. **F** Antennae ♂ and ♀. **G** Aedeagus, lateral view. **H** Aedeagus, ventral view. **I** Aedeagus, dorsal view.

Legs: Short. Femora thickened towards the second third. For variability of pro- and mesotibiae in the male see diagnosis. Metatibiae slender in both sexes, in the basal half straight, in the apical half somewhat incurved. Lengths of protarsomeres 1–5 as 8:7:6:5:25, lengths of mesotarsomeres 1–5 as 14:9:7:6:24, lengths of metatarsomeres 1–4 as 40:12:8:25.

Aedeagus: See Fig. 43G–I.

Amarygmus poringensis **n. sp.**
(Fig. 44A–H)

Holotype (♂): Borneo, Malaysia, Sabah, Kinabalu NP, Poring vic., 380 m, 9.–11.III.2007, R. Grimm (CG).

Paratypes: Same data as holotype (2♂♂ CG, 2♂♂ ZSMB).

Circumstances of collection: Edge of lowland primary forest, on rotten wood mixed with fungi, at night.

Etymology

Poringensis, derived from Poring, the collection site of the type specimens.

Diagnosis

Small, oval, dark bronze coloured, sometimes nearly black. Elytra with rows of medium-sized punctures. Genae scarcely developed, thus, the socket joint of antennomere 1 nearly entirely visible. Frons not very wide. Antennae of medium length. Male protibiae and protarsomeres 1–3 not widened, soles of protarsomeres 1–4 closely pilose.

A. genalis Bremer, 2009 (Bremer 2009: 15–16, fig. 36) is similar to *A. poringensis* n. sp. because the genae are also entirely lacking on the upperside of the head. However, this species from the Malayan Peninsula and Sabah is larger than *A. poringensis* (body length about 5.5 mm), the elytral rows consist of less punctures, the elytra are moderately longer (length/width ratio in *A. genalis* 1.34 : 1), and the upperside is dark green.

The following small species with rows of punctures on the elytra (but with developed genae) must be distinguished from *A. poringensis*:

A. expeditus n. sp.: Of similar size as *A. poringensis*, but punctures of the elytral rows somewhat smaller, elytral intervals more closely punctated, frons markedly wider, pronotal front corners more distinct.

A. jenisi Bremer, 2004 (Bremer 2004a: 46, fig. 28): With blue-coloured sides of the elytra, punctures of the elytral rows markedly smaller and partially linked by lines, legs light brown (dark brown to black in *A. poringensis*), punctures of the pronotum distinctly smaller.

A. sodalis Bremer, 2002 (Bremer 2002a: 42): Punctures of the elytral rows markedly smaller and partially linked by lines, legs light brown, male protibiae widened in apical half on inner side.

A. rolandi n. sp.: Punctures of the elytral rows smaller and partially linked by faint lines, front corners of pronotum more distinct.

A. vespertinus n. sp.: Punctures of the elytral rows markedly smaller, body somewhat narrower.

Description

Measurements: Body length 4.51–4.86 mm; body width 2.88–3.04 mm. – Ratios: Pronotum: width/length 2.02–2.15; width hind corners/width front corners 1.72–1.82. Elytra: length/width 1.25–1.32; length elytra/length pronotum 3.48–3.61; maximum width elytra/maximum width pronotum 1.30–1.33.

Colouration: Elytra dark bronze in most specimens (in one specimen black), pronotum blackish; lustrous. Underside black. Legs blackish brown, tarsi somewhat lighter brown. Antennomeres 1–3 dark brown, 4–11 black. Mentum and palpi light brown.

Head: Frons a little wider than length of antennomere 4 (like 12 : 11), situated higher than eyes. Genae rudimentary, only in their hind parts narrowly developed, socket joint of antennomere 1 not covered by the genae as it is normally the case in Amarygmini. Fronto-clypeal suture arched and incised on the whole width of the head. Clypeus stretched forwards, slightly convex transversely and longitudinally; clypeus and frons with minute, widely separated punctures; nearly recumbent short hairs originating from clypeal punctures. Mentum widened anteriorly, with rounded sides and a rounded transition between base and sides; lateral and basal margins flat, lustrous, space in between lateral margins opaque, slightly convex transversely. Underside of neck black, microreticulated, on its anterior part with medium-sized punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Wide, distinctly convex transversely, slightly convex longitudinally. Lateral margins narrowing and bent anteriorly, straight in the posterior two-thirds. Front corners widely rounded. Anterior margin very slightly excavated. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view well visible. Front corners in lateral view widely rounded, obtuse; hind corners more angular, obtuse. Surface with small, distinct, rather closely set punctures, in the middle a narrow, longitudinal area with less punctures.

Scutellum: Triangular, with a few tiny punctures.

Elytra: Oval, convex transversely and longitudinally. Maximum width and height somewhat anterior to the middle. Shoulders slightly prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view narrowly visible over their whole length. With rows of medium-sized punctures; distance between punctures on disc in row 4 about 1–2 times diameter of a puncture; about 32 punctures in row 4. Intervals flat, with very small, widely separated punctures.

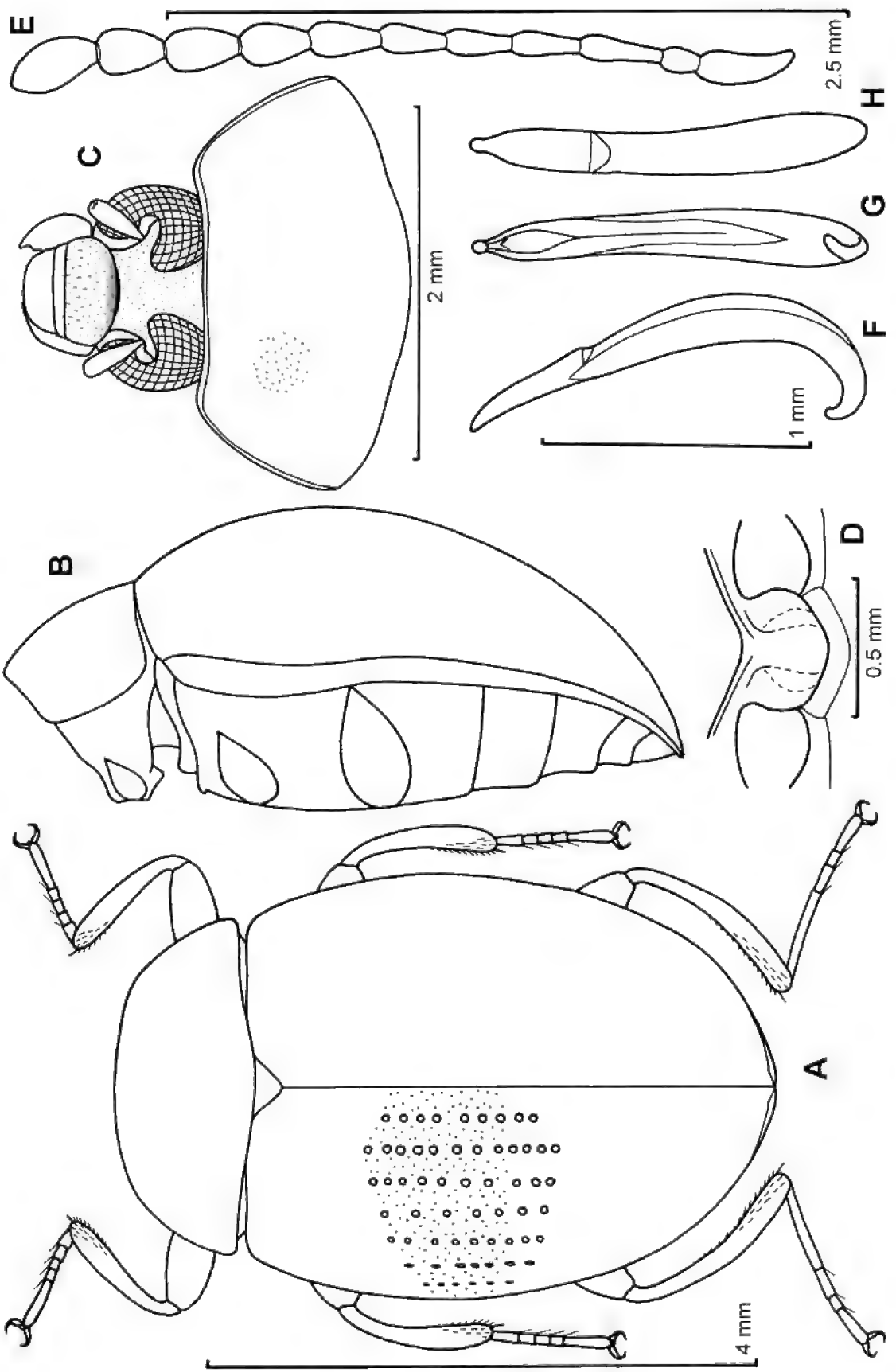


Fig. 44. *Amarygmus poringensis* n. sp. – **A** Habitus, ♂. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

Prosternum: Anterior margin narrowly bent upwards, slightly retracted in its middle, forming an obtuse angle. Apophysis very wide, short, along coxae with remarkably broad, slightly raised margins, space in between with a wide, shallow groove; the widely rounded apex positioned just behind coxae.

Mesosternum: Hind part wide, very short; anterior margin slightly excavated in the middle.

Metasternum: Anterior margin between mesocoxae rounded, coarsely bordered. Anterior part of disc with some very large punctures, posterior part with a few tiny punctures. Median line neither depressed nor incised.

Sternites: Anterior margin of sternite 1 between metacoxae widely ogival, indistinctly bordered. Sternites with very small to tiny, widely separated punctures. Sternite 5 apicomedially not depressed in males.

Antennae: Of medium length, reaching to anterior third of elytra. Length/width ratio of antennomeres 1–11 equals to 15:6 / 7:5 / 14:5 / 11:5 / 12:5 / 11:6 / 13:8 / 13:8 / 12:8 / 12:8 / 15:8.

Legs: Short. Femora thickened towards the second third. Protibiae somewhat thickened anteriorly, slightly bent; meso- and metatibiae bent. Lengths of protarsomeres 1–5 as 4:4:4:4:18, lengths of mesotarsomeres 1–5 as 8:7:5:4:17, lengths of metatarsomeres 1–4 as 29:11:5:17.

Aedeagus: See Fig. 44F–H.

Amarygmus praecellens **n. sp.**
(Fig. 45A–H)

Holotype (♂): Malaysia, Borneo, Sarawak, Kubah NP, 250 m, 6.–8.III.2008, R. Grimm (CG).

Paratypes: Same data as holotype (1 ♀ CG, 1 ♀ ZSMB). – Borneo, Malaysia, Sarawak, Kubah NP nr. Matang Wildlife Centre, 19.–22.IX.2008, R. Grimm (1 sex not determined CG).

Circumstances of collection: Edge of lowland primary forest, on tree bark, at night.

Etymology

Praecellens (Lat.) = superb.

Diagnosis

Small, oval, markedly convex transversely, with a blue or green pronotum and copper-coloured elytra, lustrous; legs brown. Elytra with slightly incised striae with medium-sized punctures. Frons very narrow, antennae very long,

A. silvester Bremer, 2004 (Bremer 2004e: 122–123) from the Malayan Peninsula and Sumatra is similar because it has nearly the same size, a similar colouration of the pronotum, a very narrow frons, and slightly incised striae on the elytra, but it differs in the shorter antennae.

For differences to *A. gnitus* n. sp. see discussion under this species.

With respect to size, shape, width of the frons, and colouration there is also a similarity to *A. splendidulus* (Fabricius, 1801) (redescribed in Bremer 2005b: 52–54), but *A. splendidulus* has shorter antennae and rows of punctures on the elytra (striae in *A. praecellens*).

Description

Measurements: Body length 5.25–6.28 mm; body width 3.11–3.78 mm. – Ratios: Pronotum: width/length 1.89–2.03; width hind corners/width front corners 1.67–1.75. Elytra: length/width 1.33–1.39; length elytra/length pronotum 3.25–3.58; maximum width elytra/maximum width pronotum 1.28–1.35.

Colouration: Head black. Pronotum blue or green, lustrous. Elytra lustrous, dark green to copper-coloured with a violet tinge, and with a distinct, transverse iridescence. Scutellum brown. Legs brown. Antennomeres 1–6 brown, 7–11 black. Underside black, its colouration contrasting with the brown to reddish brown femora.

Head: Eyes very large. Frons very narrow, in male narrower than the diameter of the base of antennomere 3 (like 3 : 4), in female only slightly wider. Genae slightly raised, very narrow, situated anterolateral to the eyes, anteriorly terminating approximately at the level of the middle part of the fronto-clypeal suture. Fronto-clypeal suture straight, slightly incised, situated just in front of the eyes. Clypeus stretched forwards, somewhat convex transversely and longitudinally, with small punctures. Mentum enlarged anteriorly, front corners rounded, lateral margins wide, flat, lustrous; space in between transversely convex, opaque. Mandibles sulcated on outer surface, apically bifid.

Pronotum: Convex transversely and longitudinally. Sides anteriorly narrowed, bent. Front corners rounded. Anterior margin slightly excavated. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view narrowly visible. Front and hind corners in lateral view narrowly rounded, obtuse. Surface with very small, widely separated punctures.

Scutellum: Triangular, with a few tiny punctures.

Elytra: Slightly elongate and oval, strongly convex transversely, somewhat less convex longitudinally. Maximum width and height just anterior to the middle. Shoulders rounded. Apices of elytra mutually rounded. Lateral edges in dorsal view very narrowly visible in their whole length. With striae with medium-sized, somewhat elongate punctures; distance between punctures on disc in stria 4 about 1–1½ times diameter of a puncture; about 32 punctures in stria 4; striae scarcely incised on disc, distinctly incised laterally. Intervals very slightly convex on disc, somewhat more convex laterally and near the apex, with very small and widely separated punctures.

Prosternum: Anterior margin narrowly bent upwards laterally, interrupted in the middle. Apophysis

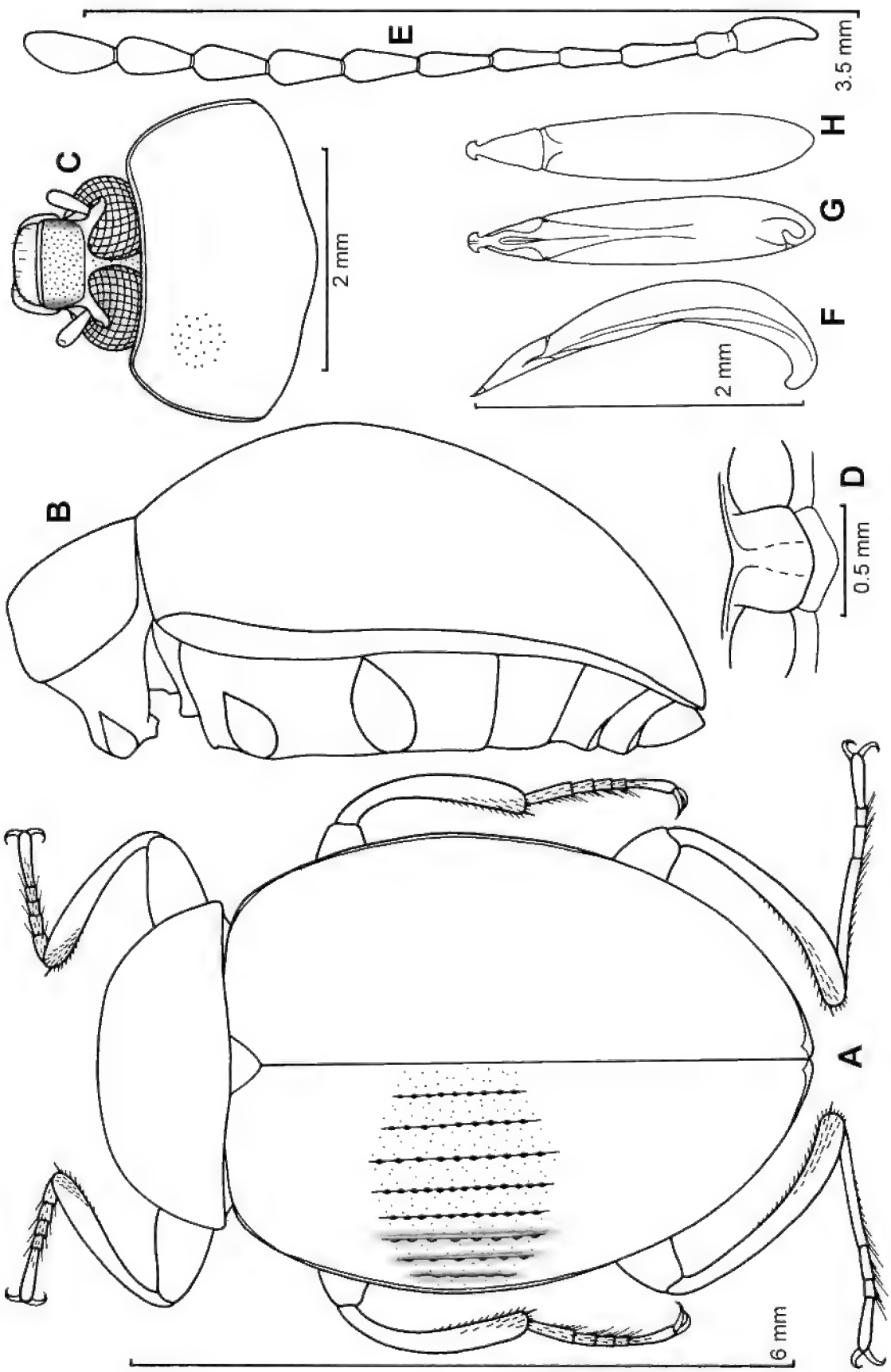


Fig. 45. *Amarygmus praecellens* n. sp. – **A** Habitus, ♂. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

short, about as wide as long; in its middle with a wide, low, longitudinal keel which extends across the whole apophysis; margins along coxae slightly raised; apophysis broadly pointed apically.

Mesosternum: Hind part wide, short; on both sides with a slightly incised sulcus; anterior margin excavated in the middle.

Metasternum: Anterior margin between mesocoxae rounded, bordered. Anterior part of disc with coarse, not very closely set punctures, posterior part with sparse and very small punctures. Median line incised on the whole length.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, coarsely bordered. Discs of sternites with sparse, tiny punctures which are the origin of recumbent short hairs.

Antennae: Rather long, reaching to middle of elytra, of same length in both sexes. Length/width ratio of antennomeres 1–11 equals to 16:8 / 9:6 / 17:5½ / 12:6 / 15:6 / 16:6½ / 16:7½ / 19:7½ / 18:7½ / 16:8 / 22:8½.

Legs: Short. Femora somewhat flattened, thickened towards the second third. Protibiae slightly bent, in male slightly widened on inner side; meso- and metatibiae distinctly bent. Protarsomeres 1–3 not widened in male. Lengths of protarsomeres 1–5 as 7:7:6:6:23, lengths of mesotarsomeres 1–5 as 17:9:9:6:23, lengths of metatarsomeres 1–4 as 45:16:10:24.

Aedeagus: See Fig. 45F–H.

Amarygmus proteus **n. sp.**
(Fig. 46A–H)

Holotype (♂): Malaysia, Borneo, Sarawak, Gunung Gading NP, 100–250 m, 9.–12.III.2008, R. Grimm (CG).

Paratypes: Same data as holotype (1 ♂ CG). – Borneo, Malaysia, Sarawak, Gunung Gading NP, 100–300 m, 23.–29.IX.2008, R. Grimm (6 ♂♂, 4 ♀♀ CG, 1 ♂ ZSMB). – Malaysia, Borneo, Sarawak, Kubah NP, 250 m, 18.–19.III.2008, R. Grimm (1 ♂, 2 ♀♀ CG; 1 ♂ ZSMB). – Malaysia, Borneo, Sarawak, Kubah NP, Matang Family Park, 200 m, 7.III.2008, R. Grimm (1 ♂ CG). – Malaysia, Borneo, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 20–150 m, 21.III.2008, R. Grimm (1 ♂ CG). – Same data as before, but 13.–15.III.2008 (2 ♀♀ CG, 1 ♀ ZSMB). – Borneo, Malaysia, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 10–200 m, 11.–14.IX.2008 (3 ♂♂, 2 ♀♀ CG; 1 ♀ ZSMB). – Same data as before, but 27.–28.IX.2008 (2 ♂♂, 5 ♀♀ CG; 1 ♂, 1 ♀ ZSMB). – Same data as before, but 4.–8.IV.2009 (7 ♂♂ CG, 1 ♂ ZSMB, 1 ♀ CG). – Malaysia, Borneo, Sarawak, NW Kuching, Matang Wildlife Centre, 50–100 m, 16.–17.III.2008, R. Grimm (10 ♂♂ CG, 2 ♂♂ ZSMB, 2 ♀♀ CG). – Borneo, Malaysia, Sarawak, Kubah NP, Matang Wildlife Centre, 19.–22.IX.2008, R. Grimm (4 ♂♂, 4 ♀♀ CG; 1 ♂, 1 ♀ ZSMB). – Borneo, Malaysia, Sarawak, Kubah NP, Matang Wildlife Centre vic., 50–100 m, 28.–31.III.2009, R. Grimm (1 ♂, 3 ♀♀ CG; 1 ♀ ZSMB). – Singapore, Dr. Will (3 ♂♂ ZMHB, 1 ♂ ZSMB, 1 ♀ ZMHB).

Circumstances of collection: In Sarawak in lowland primary forest, on rotten trunks covered with fungus (at night), or fogged in the same habitat.

Etymology

Proteus, fabulous oceanic god; as an epithet it also means variable, tricky.

Diagnosis

Of medium size, elongate oval, body markedly convex transversely. Colouration black, with reddish brown maculae as shown in Fig. 46A, antennomere 11 completely yellow or yellowish brown. Elytra with distinctly incised striae with very small punctures, intervals slightly to moderately convex. Frons relatively narrow, antennae long, slight difference in length of male and female antennae. Male protarsomeres 1–3 elongated with long erect hairs laterally (Fig. 46A); male metasternum and back of meso- and metafemora covered with long hairs. Notable difference of size between specimens.

With respect to size, shape, form of maculae and also distribution (Sarawak and Singapore) *A. nuntius* n. sp. is very similar to *A. proteus*. However, *A. nuntius* has black tarsi, a uniformly black antennomere 11, a more triangular shape of antennomeres 6–10, and a different shape of the aedeagus.

A. rufonotatus Pic, 1915 (redescribed and illustrated in Bremer 2005c: 24–25, fig. 23) has a similar shape of body, antennae and male forelegs, and a uniformly yellow antennomere 11. However, *A. rufonotatus* has three reddish brown maculae on each elytron, more closely set punctures on pronotum, no hairs on male metasternum or meso- and metafemora, and a different shape of the aedeagus.

Description

Measurements: Body length 5.41–6.93 mm; body width 3.11–3.98 mm. – Ratios: Pronotum: width/length 1.49–1.63; width hind corners/width front corners 1.81–1.97. Elytra: length/width 1.43–1.47; length elytra/length pronotum 2.95–3.20; maximum width elytra/maximum width pronotum 1.33–1.38.

Colouration: Anterior part of pronotum reddish brown, posterior part black (dividing line between both areas poorly defined). Elytra outside the reddish brown maculae black, with metallic glimmer, just behind base with a continuously transverse macula (in some specimens), in other specimens this macula is divided into two maculae by a black band at the suture. Head brown, lustrous. Femora (except the occasionally black apical apex) and tarsi reddish brown, tibiae black. Underside brown, lustrous, femora lighter brown than underside. Antennomeres 1–4 brown, 5+6 dark brown, 7–10 black, 11 reddish brown or yellow.

Head: Frons relatively narrow, of the same width in both sexes, slightly wider than length of antennomere 2. Genae narrow, short, slightly raised, anteriorly terminating behind the level of the middle part of the fronto-clypeal suture. Fronto-clypeal suture arched and incised in its

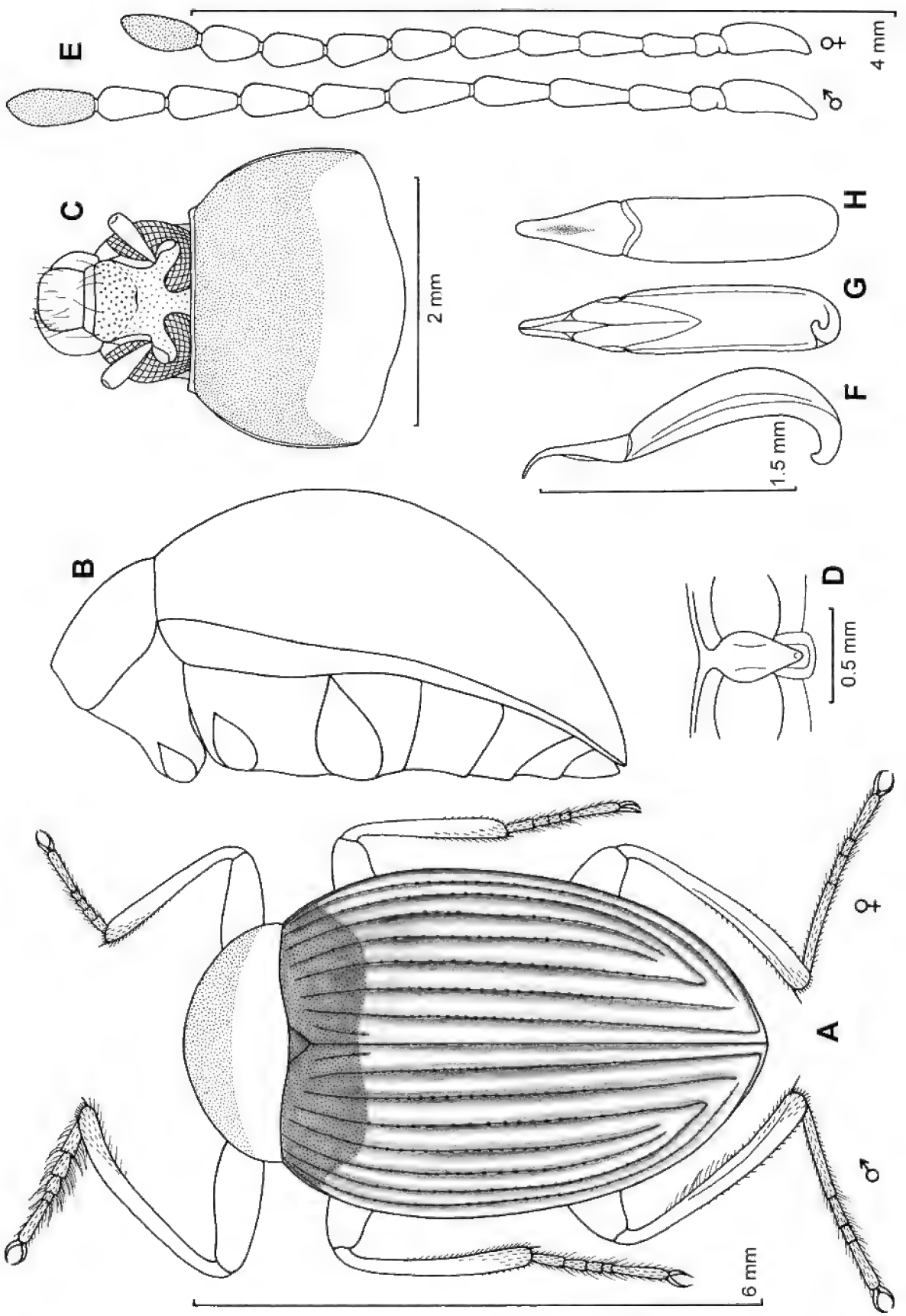


Fig. 46. *Amarygmus proteus* n. sp. – **A** Habitus (pronotum and elytra black; darker shaded area of elytra and shaded area of pronotum reddish brown); legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum (pronotum black; shaded area reddish brown). **D** Prosternal apophysis. **E** Antennae ♂ and ♀. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

middle part. Clypeus rather short; convex longitudinally, with small, distinct punctures; punctures on frons smaller and more spacious. Mentum heart-shaped, laterally with rounded, flat, lustrous margins; space in between also flat. Underside of neck with a few shallow punctures. Outer surface of mandibles with a sulcus, apically bifid.

P r o n o t u m : Not very wide, markedly convex transversely, less convex longitudinally. Sides subparallel in their posterior half, narrowing and bent anteriorly. Front corners not projecting. Anterior margin straight. Front and hind corners obtuse in dorsal view. Lateral and anterior margins continuously bordered, lateral borders and front corners visible in dorsal view. Front and hind corners in lateral view angular and obtuse. Surface with small, indistinct and irregularly set punctures.

S c u t e l l u m : Triangular, impunctate.

E l y t r a : Elongate oval. Markedly convex transversely. Maximum height and width shortly anterior to middle. Shoulders not explicitly noticeable. Apices of elytra mutually rounded. Lateral edges not visible in dorsal view. With incised striae with very small, elongate, closely set punctures; striae 1–4 not reaching the elytral base (in contrast to striae 5–7). Intervals slightly convex on disc (also near base), more convex laterally, nearly impunctate.

P r o s t e r n u m : Apophysis rather narrow, spindle-like, scarcely grooved in the middle; posterior to procoxae descending and terminating in a sharp tip, this tip very slightly lifted in lateral view; with a few short hairs.

M e s o s t e r n u m : Narrow. Anterior margin very narrowly excavated in its middle, markedly raised along the excavation. Surface moderately pilose.

M e t a s t e r n u m : Anterior margin between mesocoxae rounded, bordered. Disc with small, closely set punctures with long erect hairs (males) or only a few short hairs (females). Median line clearly incised and depressed.

S t e r n i t e s : Anterior margin of sternite 1 between metacoxae ogival, bordered. Discs of sternites with tiny, widely separated punctures; short recumbent hairs originating from these punctures in both sexes. Sternite 5 apicomedially without depression.

A n t e n n a e : Long, reaching to posterior third of elytra in males, somewhat shorter in females. Antennomeres 6–10 round in cross-sectional view. Length/width ratio of antennomeres 1–11 in male equals to 22:9 / 9:7 / 20:8 / 22:8 / 21:8 / 20:9 / 19:9 / 19:10 / 19:10 / 18:10 / 23:10, in female to 22:8 / 8:6½ / 13½:6½ / 16:7 / 16:7 / 19:9 / 17:9 / 17:9 / 17:9 / 17:9½ / 22:10.

L e g s : Long, tender. Femora thickened towards the second third; back of meso- and metafemora in males with long erect hairs which may be partially abraded. Profemora and protibiae in males markedly prolonged (in contrast to females); protibiae in their apical half markedly (in "stout" males) or slightly (in "weak" males) incurved, somewhat thickened and with erect hairs of medium length on inner side. Pro- and mesotibiae in females straight, somewhat thickened apically, with semi-erect bristles on inner side near apex. Mesotibiae straight in males; pilosity on inner side the same in both sexes. Metatibiae straight, tender in the basal half in both sexes, apically increasingly thickened and somewhat incurved. Protarsomeres 1–3 somewhat prolonged in males and, in contrast to females, with erect hairs laterally. Lengths of protarsomeres 1–5 in male as 13:11:8:5:27, lengths of mesotarsomeres 1–5 as 15:11:6:6:27, lengths of metatarsomeres 1–4 as 41:16:10:27.

A e d e a g u s : Shape of aedeagus (Fig. 46F–H) nearly identical with that of *A. furvus* (Gebien, 1927).

Amarygmus pygmaeus **n. sp.**
(Fig. 47A–H)

H o l o t y p e (sex not determined): Borneo, Malaysia, Sabah, Tambunan, 600 m, 9.V.2005, R. Grimm (CG).

P a r a t y p e s : Same data as holotype (4 sex not determined CG; 2 ♂♂ ZSMB). – Same data as holotype, but 5.II.2006 (2 sex not determined CG). – Same data as holotype, but 20.II.2006 (2 CG, 1 ZSMB, sex not determined). – Malaysia, Sabah, Tambunan, 21.XI.2006, R. Grimm (5 CG, 2 ZSMB, sex not determined). – Malaysia, Sabah, Keningau, 24.–27.XI.2006, R. Grimm (1 sex not determined CG). – Borneo, Malaysia, Sabah, E. Keningau, Bingkor, 20.–22.III.2007, R. Grimm (5 CG, 2 ZSMB, sex not determined).

Circumstances of collection: On tree bark in urban area, at night.

Etymology

Pygmaeus, from Greek πνγμή = pygmy.

Diagnosis

One of the smallest species of the genus *Amarygmus*, of oval shape. Elytra bluish black. Head with a very wide frons and a short clypeus. Elytra with rows of small punctures which are mostly linked by very faint lines; intervals with dense punctures. Pronotum and antennae short.

A. tantillus n. sp. has the same size and a very similar body shape. For the differences to *A. pygmaeus* see diagnosis under *A. tantillus*.

A. snizeki Bremer, 2002 (Bremer 2002a: 39) resembles *A. pygmaeus* because it has a wide frons, a short clypeus, short antennae, a similar shape of the pronotum, and rows of punctures on the elytra. However, *A. pygmaeus* is smaller (body length of *A. snizeki* 3.35–3.81 mm), the pronotal punctures are markedly smaller and more widely separated, and the punctures of the elytral rows are smaller and more frequently linked by faint lines.

Because of the small body length, the wide frons, and similar punctures on the elytra, there is also some similarity to *A. minutissimus* Pic, 1938 from Vietnam (redescribed in Bremer 2002a: 11); this species is only negligibly longer

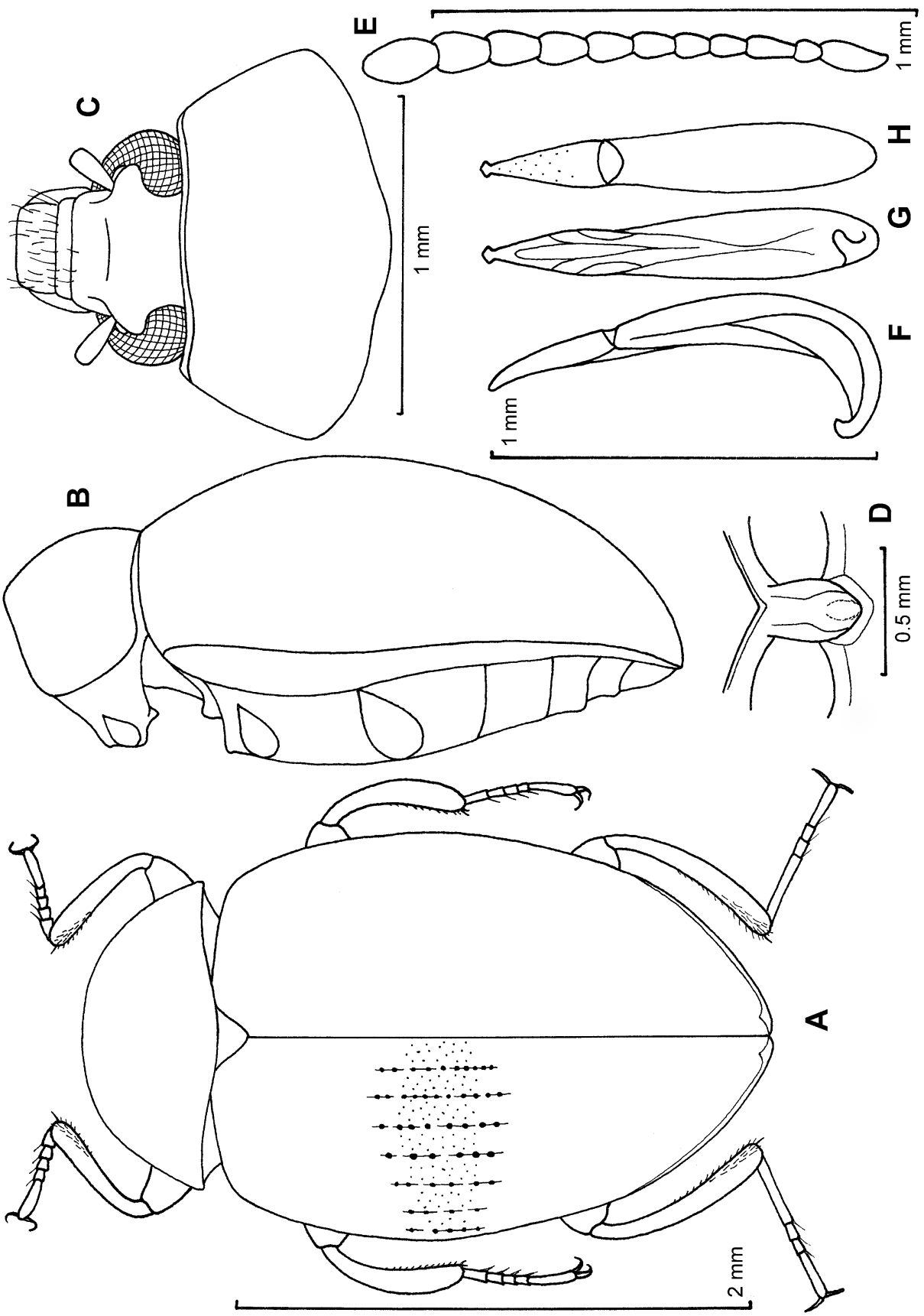


Fig. 47. *Amarygmus pygmaeus* n. sp. – **A** Habitus. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

(body length 2.75–2.88 mm). However, *A. minutissimus* has the clypeus normally stretched forwards, and the pronotal punctures and the punctures of the elytral rows are larger.

Description

Measurements: Body length 2.49–2.68 mm; body width 1.44–1.67 mm. – Ratios: Pronotum: width/length 2.00–2.11; width hind corners/width front corners 1.48–1.61. Elytra: length/width 1.24–1.36; length elytra/length pronotum 3.25–3.53; maximum width elytra/maximum width pronotum 1.30–1.32.

Colouration: Head and pronotum black, elytra bluish black, lustrous. Legs and antennae light brown. Underside brown, lustrous.

Head: Frons very wide, as wide as combined length of antennomeres 3–7. Genae very little raised. Fronto-clypeal suture distinctly incised in its middle part. Clypeus short, slightly convex. Punctures on clypeus and frons tiny, very short hairs originating from them (visible at 50-fold magnification). Mentum reversely trapezoidal, lustrous, with wide, flat margins. Underside of neck markedly microreticulated, on its anterior part with some large punctures. Mandibles apically bifid.

Pronotum: Very short, wide, trapezoidal, uniformly convex transversely, less convex longitudinally. Lateral margins anteriorly narrowing, nearly straight. Front corners rounded. Anterior margin slightly excavated. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view narrowly visible. Front corners in lateral view rounded, rectangular; hind corners angular, obtuse. Surface with tiny, widely separated punctures.

Scutellum: Triangular, with minute punctures.

Elytra: Elongate oval, markedly convex transversely, less so but still markedly convex longitudinally. Maximum width and height at the level of the anterior third. Shoulders not prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view very narrowly visible, except at shoulders. With rows of small punctures which are mostly connected by faint lines (best visible in lateral view); distance between punctures on disc in row 4 about 1–1½ times diameter of a puncture; about 22 punctures in row 4. Intervals flat, covered with minute, not very closely set punctures. Tiny hairs visible on apical part of elytra at 100-fold magnification.

Prosternum: Anterior margin narrowly bent upwards, retracted towards apophysis in its middle. Apophysis oval, maximum width somewhat posterior to procoxae; apically rounded, apicomedially with an indistinct keel.

Mesosternum: Anterior margin excavated in its middle; angles of the excavation slightly lifted.

Metasternum: Anterior margin between mesocoxae narrowly rounded, bordered. Disc with tiny, widely separated punctures. Median line narrowly incised in its posterior four-fifths.

Sternites: Anterior margin of sternite 1 between metacoxae acute-angled, with straight sides. Sternites with tiny, widely separated punctures. Sternite 5 apicomedially without depression.

Antennae: Short, reaching over base of elytra by about two antennomeres. Antennomere 11 asymmetrically rounded apically. Length/width ratio of antennomeres 1–11 equals to 7:3 / 3½:2½ / 6:2½ / 3½:2½ / 3½:3 / 4:3¾ / 4:4 / 5:4½ / 5:4½ / 5:4½ / 7:4½.

Legs: Short. Femora thickened towards the second half. Protibiae nearly straight, meso- and metatibiae bent. Protarsomeres 1–3 not widened in male, with brush-like soles. Lengths of protarsomeres 1–5 as 2:2:2:2:8, lengths of mesotarsomeres 1–5 as 5:3:3:2½:9, lengths of metatarsomeres 1–4 as 12:4:2½:9.

Aedeagus: See Fig. 47F–H.

Amarygmus rolandi **n. sp.**
(Fig. 48A–H)

Holotype (♂): Borneo, Malaysia, Sabah, Kundasang [Crocker Mts.], 1450 m, 19.V.2005, R. Grimm (CG).

Paratypes: Borneo, Sabah, Crocker Mts., 500–1900 m, Gunung Emas, 6.–21.V.1995, Ivo Jeniš leg. (1 ♂ ZSMB). – Borneo, Malaysia, Sabah, Crocker Range, Gunung Emas, 1500 m, 1.IV.2007, R. Grimm (1 ♀ CG). – Malaysia, Sabah Prov., Banjaran Crocker Mts., Gunung Alab peak, 1650–1800 m, 30.IV.–27.V.1996, M. Štrba & R. Hergovits leg. (1 ♀ CKB).

Circumstances of collection: On edge of mountainous primary and secondary forest; holotype on dead wood covered with fungus, at night.

Etymology

Kindly dedicated to Dr. Roland Grimm (Tübingen).

Diagnosis

Small, elongate oval, inconspicuous. Elytra with rows of small punctures which are linked by not incised faint lines. Frons of medium width. Antennae relatively short. Male protarsomeres 1–3 not widened, but protibiae widened in apical half on inner side. Upperside coppery with a greenish or reddish tinge, femora and tibiae black.

Amarygmus rolandi n. sp. resembles *A. nicholasi* Bremer, 2004 (Bremer 2004e: 120–121) from the Crocker Mountains. *A. nicholasi* is somewhat smaller than *A. rolandi* (body length 4.4–4.9 mm), the upperside is nearly black, the punctures of the elytral rows are smaller, the male protibiae have no apical widening, and the male protarsomeres 1–3 are widened.

A. sodalis Bremer, 2002 (Bremer 2002a: 42) shows the same shape of the male protibiae as in *A. rolandi*, but it is somewhat smaller than *A. rolandi* (body length 4.53–5.10 mm), and the femora and tibiae are light brown.

A. expeditus n. sp. also resembles *A. rolandi*, but *A. expeditus* is smaller (body length 4.01–5.10 mm), the male protibiae have no apical widening, and the frons is wider.

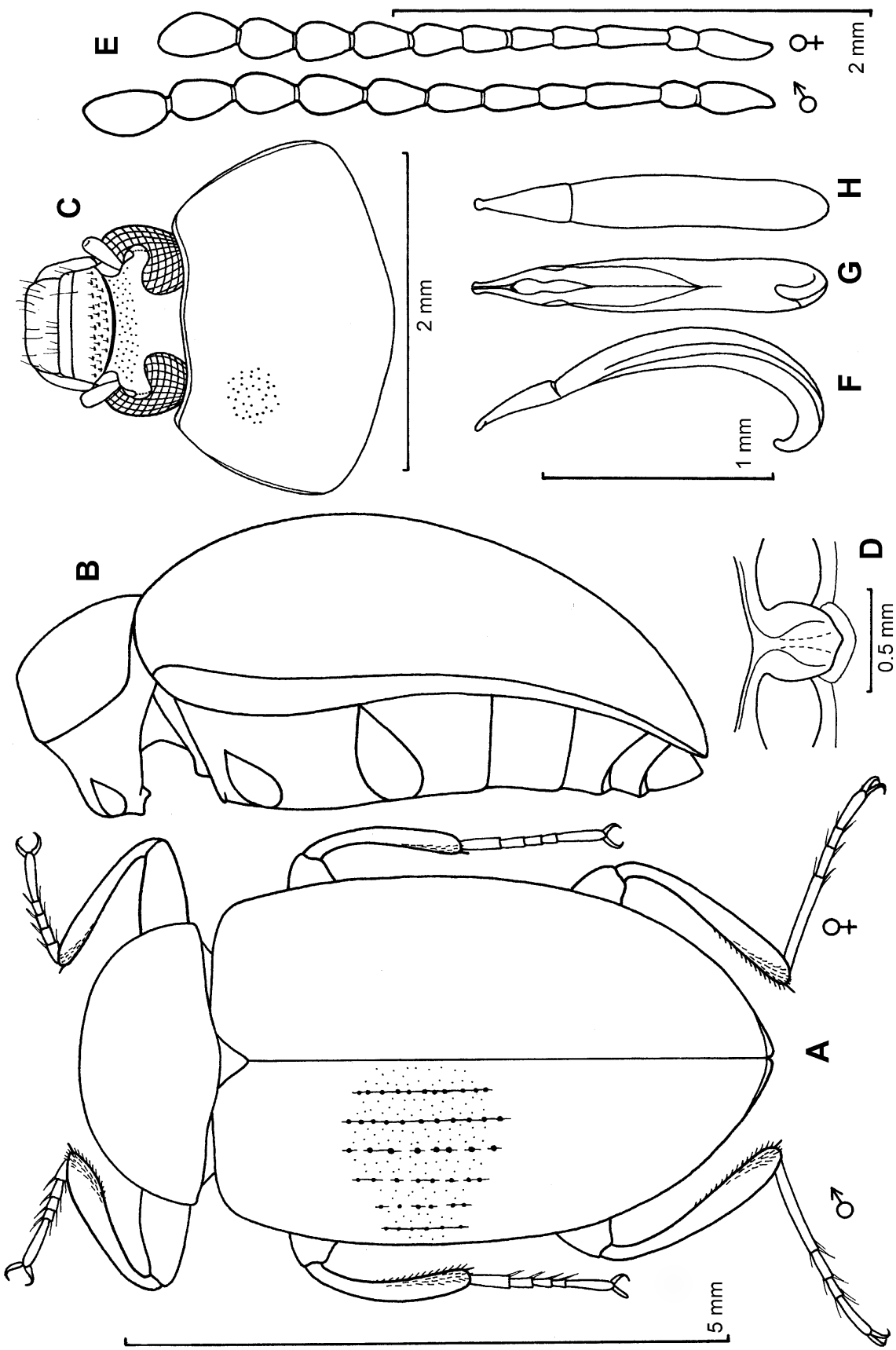


Fig. 48. *Amarygmus rolandi* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna ♂ and ♀. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

Description

Measurements: Body length 5.41–5.65 mm; body width 3.07–3.34 mm. – Ratios: Pronotum: width/length 1.94–2.00; width hind corners/width front corners 1.72–1.89. Elytra: length/width 1.40–1.50; length elytra/length pronotum 3.60–3.90; maximum width elytra/maximum width pronotum 1.35–1.39.

Colouration: Upperside greenish to reddish coppery, lustrous. Head black, lustrous. Femora and tibiae black, tarsi brown. Antennae black.

Head: Frons of medium width, slightly wider than length of antennomere 3 (like 18 : 15). Genae short, somewhat raised. Fronto-clypeal suture narrowly and distinctly incised. Clypeus relatively short; transversely convex. Clypeus and frons covered with small, not very closely set punctures. Mentum reversely trapezoidal, lateral margins wide, flat, lustrous, space in between opaque, with a few hairs. Underside of neck with medium-sized, closely set punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Uniformly and distinctly convex transversely, slightly convex longitudinally. Lateral margins narrowing anteriorly. Anterior margin somewhat excavated. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view narrowly visible in the hind half. Front corners narrowly rounded and with an angle of about 100°, hind corners somewhat more obtuse. Surface with very small, not very closely set punctures.

Scutellum: Triangular, impunctate.

Elytra: Somewhat elongate oval, markedly convex transversely and longitudinally. Maximum width and height slightly behind level of the anterior third. Shoulders not prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view shortly visible only at shoulders. With rows of small punctures which are connected by faint lines; distance between punctures on disc in row 4 about 2–3 times diameter of a puncture; about 28 punctures in row 4. Intervals flat, with tiny, widely separated punctures.

Prosternum: Anterior margin narrowly bent upwards, widely interrupted in its middle; a blunt, wide keel is originating from the middle part, extending across the whole apophysis and weakened apically. Apophysis short, oval, margins along procoxae distinctly raised, space in between with a wide groove (including the shallow keel); posterior to coxae margins roundedly narrowed towards the slightly projecting median apex; apophysis with some short erect hairs.

Mesosternum: Hind part short; anterior margin widely excavated in its middle.

Metasternum: Anterior margin between mesocoxae rounded, broadly bordered. Anterior part of disc with large, widely separated punctures, hind part with tiny, sparse punctures. Median line weakly incised.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, faintly bordered. All sternites with widely separated, tiny punctures. Sternite 5 apicomedially strongly depressed in males.

Antennae: Antennae reaching to anterior third of elytra. Length/width ratio of antennomeres 1–11 equals to 12:6½ / 7:5 / 15:5 / 10:5 / 10:5½ / 10:6 / 12:7 / 14:8 / 12:8 / 12:8 / 17:9.

Legs: Of medium length. Femora thickened towards the second third. Protibiae in males straight on outer side, clearly widened in the apical half on inner side; in females nearly straight, not widened on inner side. Mesotibiae slightly bent in both sexes. Metatibiae on outer side slightly bent in both sexes, on inner side in the apical three-fifths slightly widened and with rather short erect, tender hairs. Lengths of protarsomeres 1–5 as 7:6:6:5:21, lengths of mesotarsomeres 1–5 as 16:9:7:6:22, lengths of metatarsomeres 1–4 as 37:13:5½:20.

Aedeagus: See Fig. 48F–H.

Amarygmus sarawakensis **n. sp.**
(Fig. 49A–H)

Holotype (♂): Malaysia, Borneo, Sarawak, Kubah NP, 250 m, 6.–8.III.2008, R. Grimm (CG).

Paratypes: Malaysia, Pahang, Tioman Islands, Kampong Tekek–Kampong Juara, 2°48'N 104°11'E, 205 m, 7.–23.II.2000, M. Štrba leg. (1 ♂ ZSMB). – W Malaysia, N of Kuala Lumpur, Templer Park, 10.–11.II.1998, S. Bečvář leg. (1 ♀ SSB).

Circumstances of collection (of holotype): Edge of primary forest, on the bark of a tree; collected at night.

Etymology

Sarawakensis, derived from Sarawak.

Diagnosis

Small, nearly ovate. Frons extremely narrow. Elytra with slightly incised striae with medium-sized punctures. Intervals slightly convex on disc, with minute, widely separated punctures. Upperside dark copper-coloured with a greenish tinge on pronotum, legs light brown. Antennae of medium length, in both sexes of the same length.

Amarygmus sarawakensis n. sp. is remarkably similar to *A. subtilis* Bremer, 2001 (Bremer 2001b: 99) from Sumatra. However, males of *A. subtilis* have a distance between the eyes of 1½ diameter of an ocellus (somewhat wider in females) (eyes touching each other in *A. sarawakensis*), and the top of the aedeagus is relatively long, straight in lateral view and right-angled and enlarged in dorsal view (shorter, inflected in lateral view and subparallel in dorsal view in *A. sarawakensis*).

Other species of *Amarygmus* with a very narrow frons are markedly larger than *A. sarawakensis*.

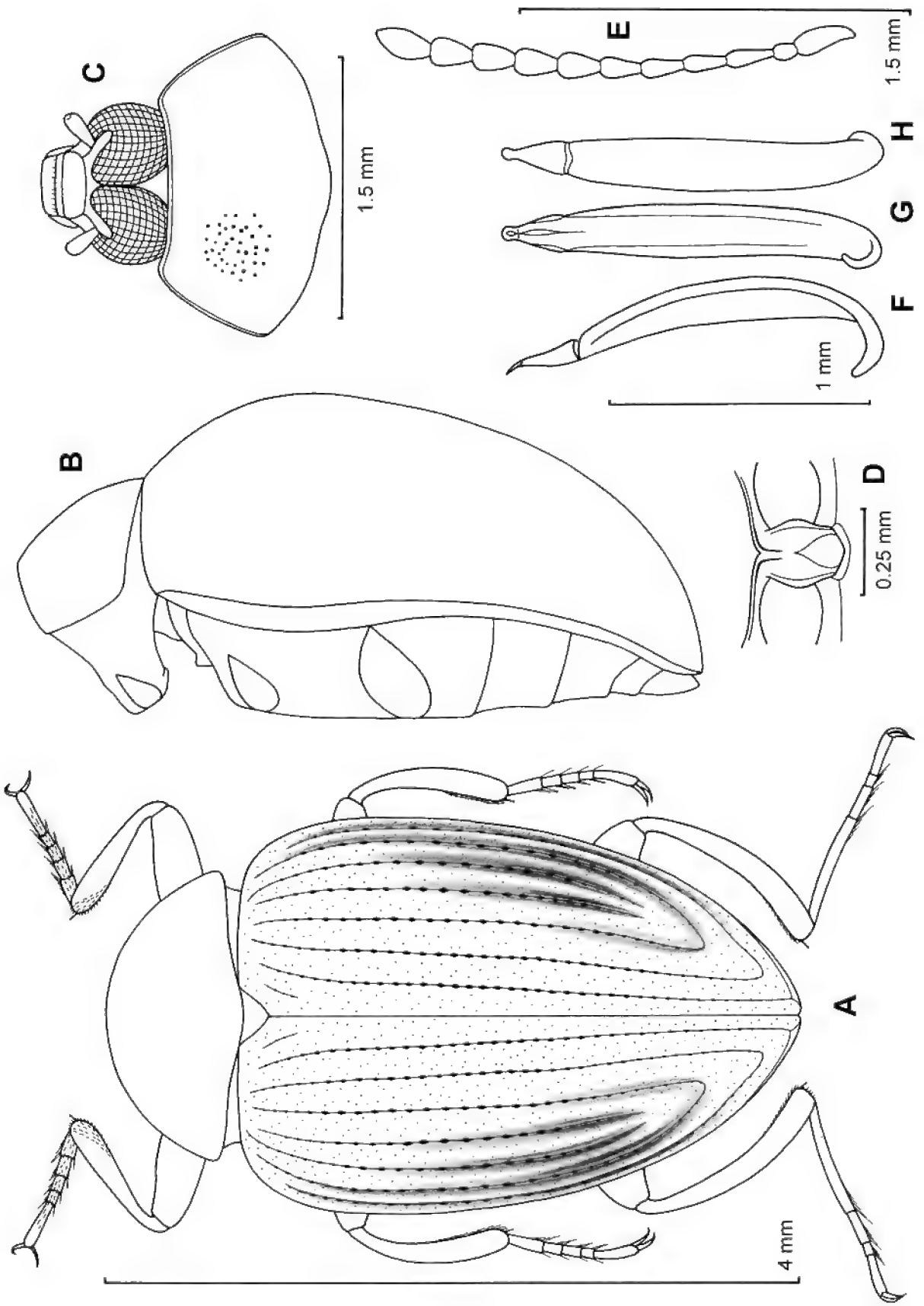


Fig. 49. *Amarygmus sarawakensis* n. sp. – **A** Habitus, ♂. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

Description

Measurements: Body length 3.22–3.70 mm; body width 1.87–2.18 mm. – Ratios: Pronotum: width/length 1.87–1.95; width hind corners/width front corners 1.67–1.83. Elytra: length/width 1.36–1.42; length elytra/length pronotum 3.20–3.38; maximum width elytra/maximum width pronotum 1.25–1.33.

Colouration: Upperside lustrous. Elytra dark coppery. Pronotum dark green. Scutellum and area around it brownish brightened. Underside brown. Metasternum and sternites slightly lustrous. Femora light brown (lighter brown than underside), tibiae and tarsi light brown. Antennomeres 1–4 light brown, 5 darker brown, 6–11 black.

Head: Eyes very large, touching each other on the frons. Genae narrow, short, slightly raised. Fronto-clypeal suture visible only in the middle as a very faint sulcus. Clypeus moderately stretched forwards, with minute, sparse punctures. Mentum reversely trapezoidal, lateral margins wide, lustrous, space in between slightly convex transversely. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Lateral outline following the outline of the elytra, markedly convex transversely, slightly convex longitudinally. Lateral margins narrowing anteriorly, bent. Front corners rather depressed, rounded. Anterior margin not excavated. Lateral and anterior margins continuously bordered. Lateral borders narrowly visible, except borders near front corners. Front and hind corners in lateral view slightly obtuse, front corners rounded, hind corners angular. Surface with medium-sized, coarse, mostly spaciously and irregularly set punctures.

Scutellum: Triangular, impunctate.

Elytra: Ovate, markedly convex transversely, evenly but less markedly convex longitudinally. Maximum width at the level of the anterior third, margins moderately bent and narrowed posteriorly, maximum height somewhat posterior to maximum width. Shoulders not prominent. Apices of elytra mutually rounded. Lateral edges not visible in dorsal view. With moderately incised striae with medium-sized, irregularly set punctures; distance between punctures on disc in stria 4 about 2 times diameter of a puncture; about 30 punctures in stria 4. Intervals very slightly convex on disc, distinctly convex laterally, with sparse, tiny punctures.

Prosternum: Anterior margin narrowly bent upwards, widely interrupted in the middle, where a triangular keel is directed towards apophysis. Apophysis of medium width, margins somewhat widened along coxae, raised, space in between with a deep groove; margins posterior to coxae somewhat convergent; apex broadly pointed; with a few erect hairs of medium length on apophysis.

Mesosternum: Anterior margin excavated in its middle; lateral margins moderately raised; with a few tender hairs of medium length.

Metasternum: Anterior margin between mesocoxae rounded, coarsely bordered. Anterior part of disc with a few small punctures with tender hairs of medium length; these hairs are partially erect, partially recumbent. Median line shallowly depressed.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, rather broadly bordered. Sternites impunctate. Sternite 5 apicomedially slightly depressed in male.

Antennae: Of medium length, reaching to anterior third of elytra. Length/width ratio of antennomeres 1–11 equals to 12:4 / 5:3 / 9:3 / 6½:3 / 8:4 / 7:4½ / 8½:5 / 8½:5 / 8:5 / 8:5 / 11:5.

Legs: Short. Femora thickened towards the second third. Protibiae straight on outer side, somewhat widened on inner side in the apical half; meso– and metatibiae thickened apically, bent. Pro– and mesotibiae on inner side in the apical half with an area of closely set, semi-erect hairs of medium length. Protarsomeres 1–3 slightly widened in male. Lengths of protarsomeres 1–5 as 6:5:4:3:13, lengths of mesotarsomeres 1–5 as 10:5½:5:4:14, lengths of metatarsomeres 1–4 as 30:12:4:13.

Aedeagus: See Fig. 49F–H.

Amarygmus singulus **n. sp.**
(Fig. 50A–H)

Holotype (♂): Sabah, Kota Kinabalu, nachts, an Allee-Bäumen, 22.II.2006, Ulf Bremer leg. (ZSMB).

Circumstances of collection: In urban area on the bark of an avenue tree, at night.

Etymology

Singulus (Lat.) = solo.

Diagnosis

Small, elongate oval, markedly convex. Elytra with somewhat incised striae. Frons of medium width. Upperside dark copper-coloured, lustrous. Protibiae in male somewhat widened and flattened in the apical half on inner side.

Amarygmus singulus n. sp. belongs to a group of small species which have a widening on the inner side of the male protibiae. They are mostly inconspicuous and difficult to define.

A. singulus n. sp. is especially similar to *A. secretus* Bremer, 2002 (Bremer 2002a: 35) from Sarawak and Sabah. Both species have a frons of similar width. *A. secretus* is narrower than *A. singulus*, the maximum elytral width is situated slightly anterior to the middle (at the anterior third in *A. singulus*), the clypeus is situated clearly below the level of the frons, and at the fronto-clypeal suture there is a slope between frons and clypeus (in *A. singulus* frons and clypeus on the same level and fronto-clypeal suture markedly incised in the middle), meso- and metatibiae narrower.

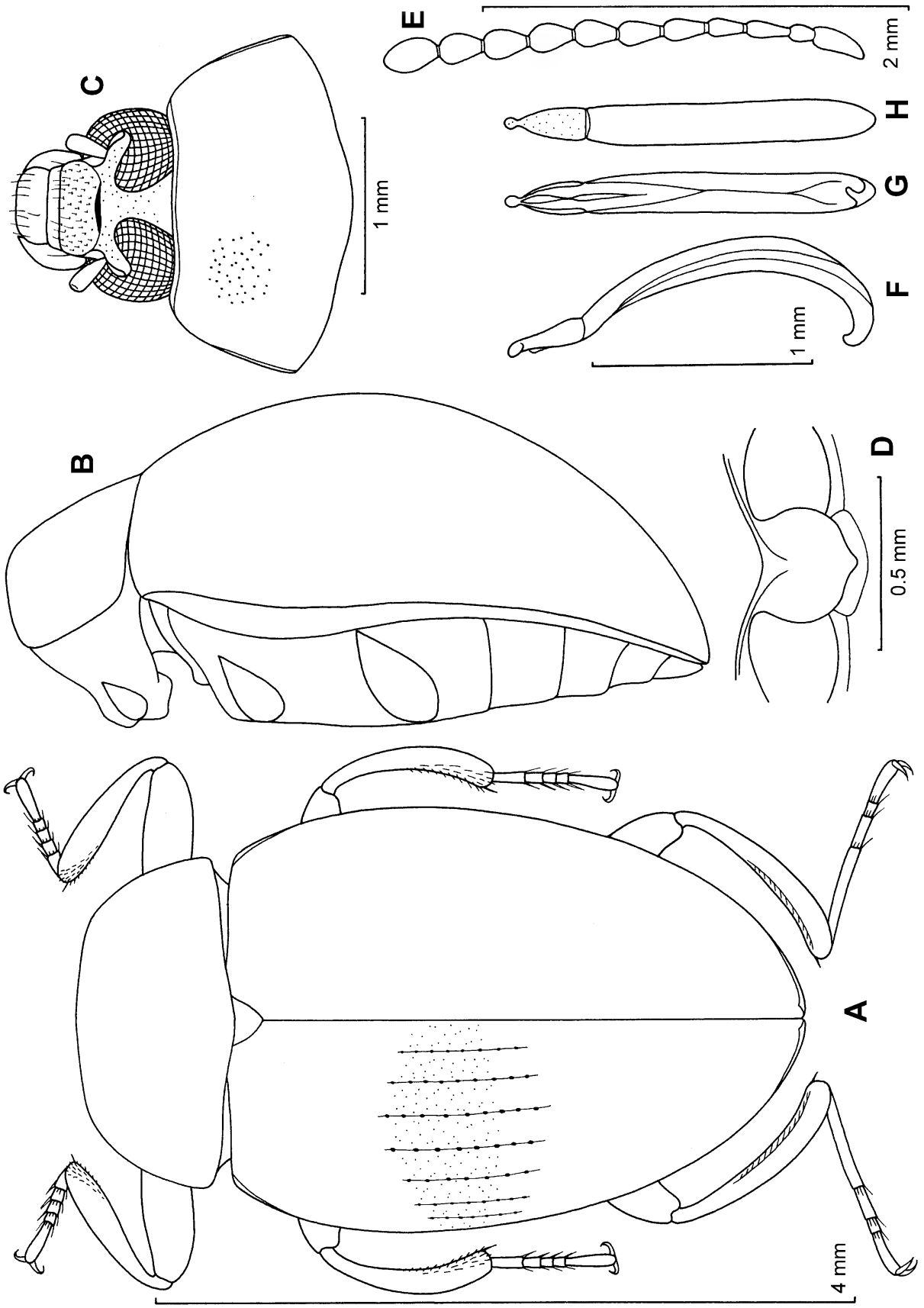


Fig. 50. *Amarygmus singulus* n. sp. – **A** Habitus, ♂. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

A. crenis Bremer, 2009 (BREMER 2009: 11–12, fig. 33) from the Malayan Peninsula also resembles *A. singulus*. *A. crenis* is somewhat smaller than *A. singulus* (body length 3.27–3.42 mm), the frons is wider, elytral interval 1 is brightened by reddish brown colour (dark as the other intervals in *A. singulus*), and the elytral intervals are more closely punctated.

Description

Measurements: Body length 3.93 mm; body width 2.33 mm. – Ratios: Pronotum: width/length 1.92; width hind corners/width front corners 1.67. Elytra: length/width 1.32; length elytra/length pronotum 3.29; maximum width elytra/maximum width pronotum 1.30.

Colouration: Upperside lustrous, dark copper-coloured. Femora and tibiae brown, tarsi light brown. Antennomeres 1–4 light brown, 5–11 increasingly darker up to black (antennomere 11 apically brightened). Underside auburn, lustrous (including sternites).

Head: Frons moderately wide, its width corresponding to the length of antennomere 4, with minute punctures which nearly disappear behind fronto-clypeal suture. Genae narrow, slightly raised. Fronto-clypeal suture rather widely and deeply incised. Clypeus moderately stretched forwards, covered with medium-sized punctures which are the origin of short, anteriorly directed hairs. Mentum reversely trapezoidal, lateral margins flat, lustrous, space in between less lustrous, somewhat convex transversely, with a longitudinal, lustrous clasp in its middle. Underside of neck with transversely aligned and joined punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Wide, distinctly convex transversely, less convex longitudinally. Lateral margins narrowing anteriorly, bent. Front corners rounded. Anterior margin somewhat excavated. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view visible. Front and hind corners in lateral view similarly obtuse. Surface with small, distinct, irregularly set punctures.

Scutellum: Triangular, impunctate.

Elytra: Of half-elliptic shape, distinctly convex transversely and longitudinally. Maximum width at the level of the anterior third. Shoulders slightly prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view visible only at the apex. With slightly incised striae with small to medium-sized, partially rhombic punctures; distance between punctures on disc in stria 4 about 2 times diameter of a puncture; about 24 punctures in stria 4. Intervals flat on disc, weakly convex laterally, with tiny, widely separated punctures.

Prosternum: Anterior margin narrowly bent upwards, interrupted near the middle; a blunt keel originating from the anterior margin, extending across the whole apophysis. Apophysis rounded, with a slightly pointed apex, lateral margins along procoxae not raised, thus the whole apophysis unusually flat; with some tender hairs.

Mesosternum: Anterior margin excavated in its middle; margins of the excavation slightly raised like a roll; with some short, tender hairs.

Metasternum: Anterior margin between mesocoxae rounded, coarsely bordered. Disc with some coarse punctures behind anterior margin, otherwise with tiny, very widely separated punctures with some short, tender hairs. Median line slightly incised in its posterior part.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, narrowly bordered. Sternites impunctate. Sternite 5 apicomedially very slightly depressed in male.

Antennae: Antennae reaching to about anterior third of elytra. Length/width ratio of antennomeres 1–11 equals to 10:5 / 6:4 / 11:4 / 8½:4½ / 8½:5½ / 9:6 / 9½:6½ / 9½:6½ / 9½:6½ / 9½:6½ / 13:7.

Legs: Short. Femora thickened towards the second third. Protibiae in male on outer side slightly bent, on inner side widened in its apical half, the widened part slightly depressed on its underside. Mesotibiae bent, distinctly compressed and widened apically. Metatibiae also compressed, widened and markedly bent. Protarsomeres 1–3 not widened in male. Lengths of protarsomeres 1–5 as 3:3:3:3:13, lengths of mesotarsomeres 1–5 as 10:5:4:4:14, lengths of metatarsomeres 1–4 as 26:10:4½:12.

Aedeagus: See Fig. 50F–H.

Amarygmus tantillus **n. sp.**
(Fig. 51A–H)

Holotype (♂): Borneo, Malaysia, Sabah, Keningau, 10.II.2006, R. GRIMM (CG).

Paratypes: Same data as holotype (2 ♂♂ CG, 1 ♂ ZSMB, 3 ♀♀ CG, 1 ♀ ZSMB). – Same data as holotype, but 6.–7.II.2006 (11 ♂♂ CG, 5 ♂♂ ZSMB, 9 ♀♀ CG, 4 ♀♀ ZSMB). – Same data as holotype, but 17.–19.II.2006 (10 ♂♂ CG, 2 ♂♂ ZSMB, 3 ♀♀ CG). – Sabah, Keningau, 400 m, nachts, auf der Rinde von Bäumen, 17.II.2006, H. J. BREMER leg. (4 ♂♂ ZSMB, 1 ♂ BMNH, 1 ♀ ZSMB). – Malaysia, Sabah, Keningau, 24.–27.XI.2006, R. GRIMM (3 ♂♂ CG, 1 ♂ ZSMB). – Borneo, Malaysia, Sabah, Keningau, 300 m, 20.–22.III.2007, R. GRIMM (7 ♂♂ CG, 2 ♂♂ ZSMB, 1 ♂ CM, 6 ♀♀ CG). – Borneo, Malaysia, Sabah, E. Keningau, Bingkor, 20.–22.III.2007, R. GRIMM (1 ♂, 1 ♀ CG). – Borneo, Malaysia, Sabah, Tambunan, 500 m, 20.II.2006, R. GRIMM (1 ♀ CG). – Malaysia, Sabah, Tambunan, 21.XI.2006, R. GRIMM (1 sex not determined CG).

Circumstances of collection: On the bark of trees, mainly in gardens and parks, at night.

Etymology

Tantillus (Lat.) = very small.

Diagnosis

Very tiny, oval, slightly elongate, outline of the elytra following the outline of the pronotum. Elytra with slightly incised striae with small to medium-sized punctures;

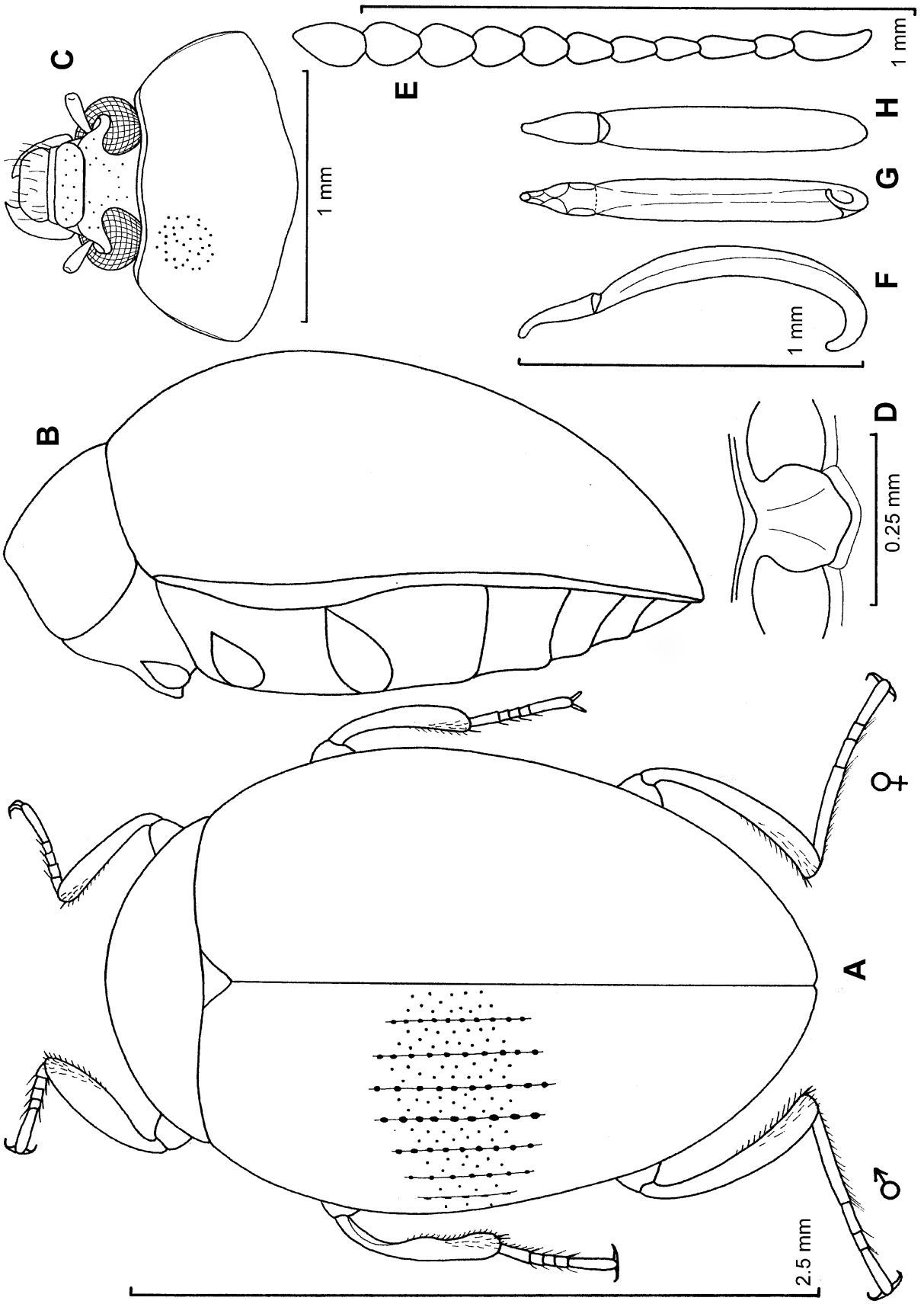


Fig. 51. *Amarygmus tantillus* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

intervals on disc either flat or very slightly convex, laterally clearly convex. Frons of medium width. Upperside coppery. Especially characterized by features of the male legs (see description below). Male protarsomeres not widened. Frons in males somewhat narrower than in females.

This is currently the smallest species of *Amarygmus* which I know. With respect to size it can only be compared with the equally tiny *A. pygmaeus* n. sp. from the same area. Shape of elytra and striae and intervals are similar in both species. However, *A. pygmaeus* has the male pro- and mesotibiae not enlarged on inner side, the frons is wider, the fronto-clypeal suture is very slightly incised (clearly incised in the middle in *A. tantillus*), the pronotum is faintly punctured (distinctly punctured in *A. tantillus*), and the elytra are blackish blue (coppery in *A. tantillus*).

Description

Measurements: Body length 2.14–2.45 mm; body width 1.36–1.50 mm. – Ratios: Pronotum: width/length 2.05–2.12; width hind corners/width front corners 1.57–1.72. Elytra: length/width 1.34–1.37; length elytra/length pronotum 3.59–3.81; maximum width elytra/maximum width pronotum 1.27–1.32.

Colouration: Elytra dark coppery, lustrous. Pronotum dark green, slightly microreticulated. Scutellum brown. Head brown, lustrous. Underside and legs brown. Antennomeres 1–7 brown, 8–11 dark brown to black (antennomere 11 apically brightened).

Head: Frons of medium width, somewhat wider than combined length of antennomeres 3+4 (like 10 : 9), descending towards fronto-clypeal suture. Genae short, anteriorly terminating somewhat behind the middle part of the fronto-clypeal suture. Fronto-clypeal suture clearly incised in its middle part. Clypeus rather short, slightly convex longitudinally. Punctures on clypeus and frons small, not very closely set. Mentum reversely trapezoidal, lateral margins wide, lustrous, flat, space in between opaque, slightly convex. Underside of neck with narrow, transverse sulci, punctures nearly lacking. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Wide. Lateral margins slightly convergent anteriorly, straight in the posterior half, somewhat bent in the anterior half. Anterior margin straight. Front corners widely rounded. Lateral and anterior margins continuously bordered. Lateral borders narrowly visible in the posterior four-fifths. Rounded front corners and angular hind corners slightly obtuse in lateral view. Surface with distinct, medium-sized, irregularly set punctures.

Scutellum: Triangular, with a few tiny punctures.

Elytra: Oval, slightly oblong, convex transversely and longitudinally. Maximum height and width at the level of the anterior third. Shoulders slightly noticeable. Apices of elytra mutually rounded. Lateral edges in dorsal view narrowly visible. With somewhat incised striae; distance between punctures in striae 3 and 4 about 1½–2 times diameter of a puncture. Intervals with very small, distinct, not very closely set punctures.

Prosternum: Anterior margin narrowly bent upwards, retracted towards apophysis in the middle, where it is acute-angled. Apophysis wide, flat, laterally rounded, apically broadly pointed.

Mesosternum: Anterior margin slightly excavated in its middle; lateral margins opaque, contrasting with the lustrous middle part.

Metasternum: Disc with a few minute punctures. Median line very faintly incised.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, narrowly bordered. Sternites 1 and 2 with some small punctures, subsequent sternites impunctate. Sternite 5 apicomedially not depressed in males.

Antennae: Short, reaching to anterior fifth of elytra. Lengths of antennomeres 1–11 equal to 6:4:5:4:4½:4:4:4:4:4:6.

Legs: Short. Femora thickened towards the second third. Protibiae in females nearly straight on inner side, in males distinctly widened on about apical three-fourths. Mesotibiae in females bent on outer side, nearly straight in their apical half on inner side; mesotibiae in males straight on outer side, distinctly widened at about midlength on inner side, the widening with a few faint erect hairs of medium size. Metatibiae markedly bent in both sexes. Lengths of metatarsomeres 1–4 as 13:5:4:7½.

Aedeagus: See Fig. 51F–H.

Amarygmus urbanus **n. sp.**
(Fig. 52A–J)

Holotype (♂): Borneo, Malaysia, Sabah, Kota Kinabalu, Inanam, 22.II.2006, R. Grimm (CG).

Paratypes: Same data as holotype (1 ♀ ZSMB). – Borneo, Malaysia, Sabah, Keningau, 10.II.2006, R. Grimm (1 ♀ CG, 1 ♂ ZSMB). – Malaysia, Borneo, Keningau, 24.–27.XI.2006, R. Grimm (1 sex not determined CG). – Borneo, Malaysia, Sabah, Keningau, 300 m, 20.–22.III.2007, R. Grimm (1 ♀ CG). – Borneo, Malaysia, Sabah, E. Keningau, Bingkor, 20.–22.III.2007, R. Grimm (1 ♀ CG). – Borneo, Malaysia, Sabah, Kinabalu NP, Poring vic., 380 m, 9.–11.III.2007, R. Grimm (1 ♂ CG, 2 ♂♂ ZSMB). – Borneo, Malaysia, Sabah, Sepilok, 12.–13.III.2007, R. Grimm (1 ♂, 2 ♀♀ CG). – Malaysia, Borneo, Sarawak, Kuching, Reservoir Park, 50 m, 4.–5.III.2008, R. Grimm (3 ♂♂ CG, 1 ♂ ZSMB). – Same data as before, but 9.–10.IX.2008 (1 ♀ CG). – Borneo, Sabah, Tawau Hills Park, 21.–22.X.2009, U. Bremer, primärer Tiefland-Regenwald, nachts auf Baumrinde.

Circumstances of collection: The holotype has been collected at night in the city area of Kota Kinabalu on the bark of an avenue tree; some paratypes on tree bark in gardens and parks, at night.

Etymology

Urbanus (Lat.) = citizen.

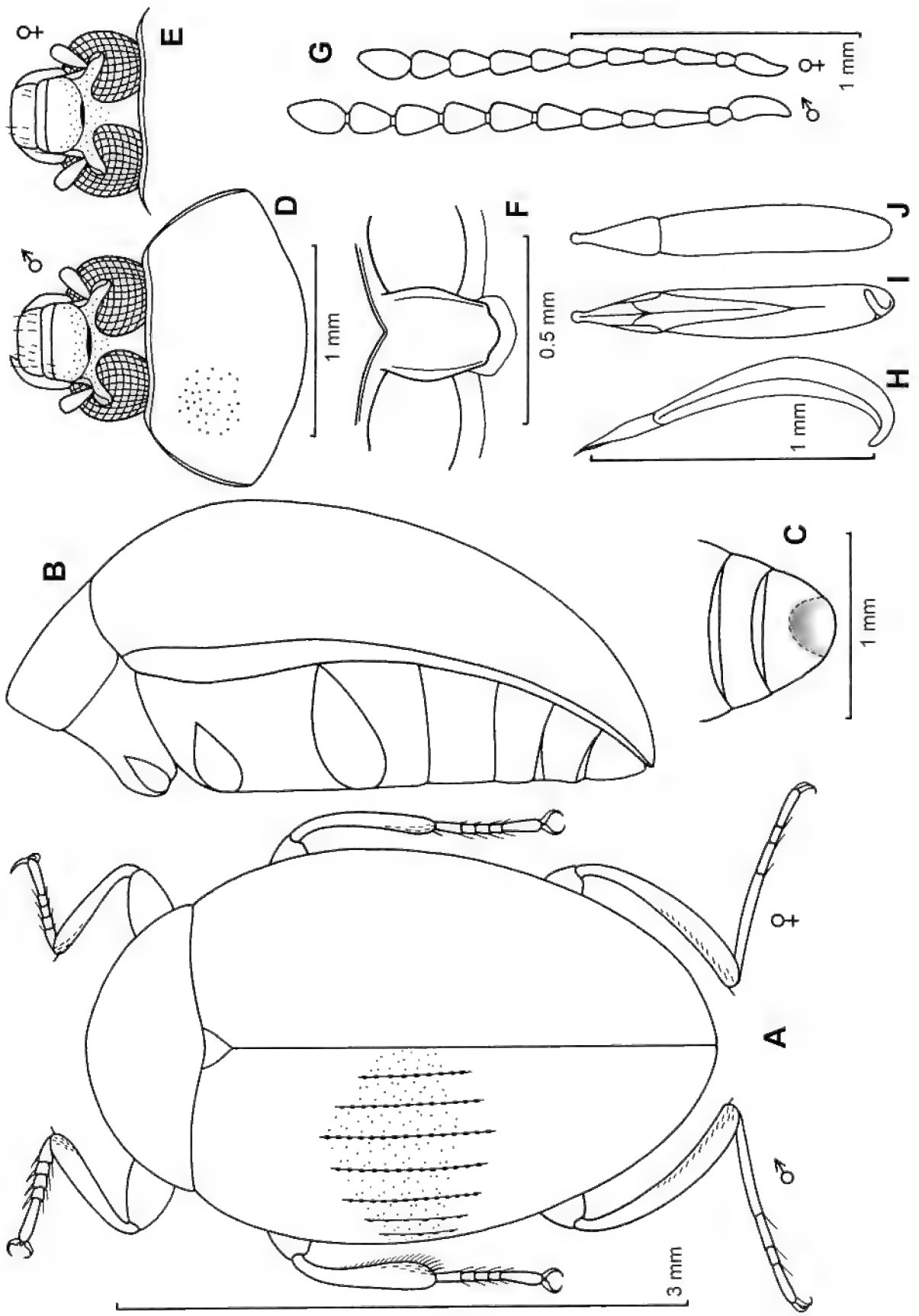


Fig. 52. *Amarygmus urbanus* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Sternites 3–5 ♂. **D** Head and pronotum ♂. **E** Head ♀. **F** Prosternal apophysis. **G** Antennae ♂ and ♀. **H** Aedeagus, lateral view. **I** Aedeagus, ventral view. **J** Aedeagus, dorsal view.

Diagnosis

Very small species, elongate oval. Elytra with striae. Frons rather narrow. Male protibiae widened apically on inner side; male mesotibiae similarly widened; male protarsomeres 1–3 slightly widened. Upperside black with a slight bluish tinge, legs light brown.

A. urbanus belongs to a group of very small species with elytral striae with punctures. The species of this group are difficult to separate from each other.

Amarygmus urbanus n. sp. is very similar to *A. sobrinus* Bremer, 2002 (Bremer 2002a: 41) from Sabah and the Malayan Peninsula. *A. sobrinus* is as large as *A. urbanus*, but has a brown interval 1 along the elytral suture, the punctures on the elytral intervals coarser and more closely set, the elytra more deeply incised, the punctures of the striae coarser, and the frons narrower.

A. sarawakensis n. sp. has the same size and shape as *A. urbanus*, but the frons is very narrow (in *A. sarawakensis* the eyes are touching each other on the frons).

Another very similar species of this group, also of the same size and shape, is *A. crenis* Bremer, 2009 from the Malayan Peninsula (Bremer 2009: 11–12, fig. 1). *A. crenis* has a brown interval 1 along the elytral suture, and the frons is wider than in *A. urbanus*.

Description

Measurements: Body length 3.03–3.38 mm; body width 1.91–2.02 mm. – Ratios: Pronotum: width/length 1.90–1.98; width hind corners/width front corners 1.74–1.76. Elytra: length/width 1.36–1.42; length elytra/length pronotum 3.48–3.52; maximum width elytra/maximum width pronotum 1.29–1.30.

Colouration: Head black. Pronotum and elytra black, slightly lustrous, with a slight bluish tinge. Underside brown, lustrous. Legs light brown (femora lighter brown than underside). Antennomeres 1–4 light brown, 5 dark brown, 6–11 black (antennomere 11 apically brightened). Mentum and palpi yellow. Underside of neck black

Head: Frons narrow, lustrous, with some minute punctures, approximately as wide as length of antennomere 2. Genae narrow, slightly raised, anteriorly terminating somewhat in front of the level of the middle part of the fronto-clypeal suture. Fronto-clypeal suture distinctly incised in its middle part, somewhat arched. Clypeus moderately stretched forwards, slightly convex transversely, covered with small, not very closely set punctures. Mentum reversely trapezoidal, lateral margins flat, wide, lustrous, space in between markedly convex. Underside of neck with coarse, closely set punctures anteriorly. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Not very wide, markedly convex transversely and longitudinally, on its anterior part more convex transversely than in its posterior part. Lateral margins narrowing anteriorly, bent. Front corners depressed, not visible in dorsal view. Anterior margin straight. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view visible only in their posterior three-fourths. Front corners in lateral view rounded, hind corners angular; both corners obtuse. Surface with medium-sized, rather closely set punctures.

Scutellum: Triangular, with slightly bent sides, impunctate.

Elytra: Oval, somewhat elongate, markedly convex transversely, somewhat less convex longitudinally. Maximum width and height at the level of the anterior third. Shoulders rounded. Apices of elytra mutually rounded. Lateral edges in dorsal view very narrowly visible only in the middle. With slightly incised striae with small, elongate punctures; distance between punctures on disc in stria 4 about equal to the diameter of a puncture; about 34 punctures in stria 4. Intervals very slightly convex on disc, somewhat more convex laterally, with minute, indistinct, sparse punctures.

Prosternum: Anterior margin continuously and narrowly bent upwards, somewhat retracted towards apophysis in its middle. Apophysis not very wide, lateral margins along procoxae somewhat roundly widened and raised; apophysis horizontally protruded posterior to coxae; margins behind coxae convergent (with straight margins) anteriorly, shortly retracted towards middle, rounded apically; space between coxae with a shallow groove.

Mesosternum: Hind part narrow; anterior margin excavated in its middle, area posterior to this excavation somewhat depressed, thus the lateral margins somewhat raised.

Metasternum: Anterior margin between mesocoxae rounded, bordered. Anterior fourth of the disc with several medium-sized punctures, posterior three-fourths with a few minute punctures. Median line somewhat incised in the posterior three-fourths.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, broadly bordered. Anterior borders behind metacoxae with small punctures. Sternites with minute, not very closely set punctures. Sternite 5 apicomedially strongly depressed in males.

Antennae: Of medium length. Length/width ratio of antennomeres 1–11 equals to 8:5 / 5:3 / 9:3 / 6:3 / 7:3½ / 7:4 / 7:5 / 6:5 / 7:5 / 6:5 / 10:6.

Legs: Short. Femora somewhat compressed, thickened towards the second third. Protibiae straight, in males on inner side apically thickened with an area of short hairs. Mesotibiae somewhat bent, in males apically on inner side with a short area with thick, somewhat erect hairs. Metatibiae more bent than mesotibiae. Pro- and mesotarsomeres 1–3 somewhat widened in males. Lengths of protarsomeres 1–5 in male as 3:3:3:2½:11, lengths of mesotarsomeres 1–5 as 6:5:4:3:11, lengths of metatarsomeres 1–4 as 20:8:4:12.

Aedeagus: See Fig. 52H–J.

Amarygmus verecundus **n. sp.**
(Fig. 53A–E)

Holotype (♀): Malaysia, Sabah, Sepilok, 22.–23.XI. 2006, R. GRIMM (CG).

Paratypes: Same data as holotype (1 damaged, sex not determined, probably ♀ ZSMB). – Malaysia, Sabah, Ranau, 28.XI.2006, R. GRIMM (1 damaged, sex not determined, probably ♀ CG).

Circumstances of collection: On tree bark in park-like habitats; in Sepilok at edge of lowland primary forest.

Etymology

Verecundus (Lat.) = unpretentious.

Diagnosis

Small, elongate oval. Elytra with striae with small, elongate punctures. Frons rather narrow. Antennae of medium length. Pronotum, and less intensively elytra, with slight coloured reflections. Metatarsomere 1 longer than combined metatarsomeres 2–4.

A. verecundus n. sp. resembles in shape, elytral striae and intervals *A. tenellus* Bremer, 2003 (BREMER 2003b: 60–61) from Sabah, but *A. tenellus* is distinctly larger (body length 6.26–6.40 mm). Because of the body shape it can be suspected that both species belong to the species group affine *A. fulgurans* Gebien, 1927, but this cannot be proved because only females are known.

Description

Measurements: Body length 4.47–4.59 mm; body width 2.41–2.67 mm. – Ratios: Pronotum: width/length 1.85–1.98; width hind corners/width front corners 1.56–1.59. Elytra: length/width 1.50–1.60; length elytra/length pronotum 3.81–4.04; maximum width elytra/maximum width pronotum 1.28–1.35.

Colouration: Pronotum purple, with coloured reflections especially in its hind part. Elytra filthy green, modestly lustrous, with a narrow purple band along the suture and with a purple spot on the shoulders. Underside blackish brown, lustrous. Femora and tibiae dark brown, tarsi brown. Antennomeres 1–6 brown, 7–11 black.

Head: Frons rather narrow, as wide as the diameter of antennomere 2. Genae narrow, slightly raised, anteriorly terminating at the level of the middle part of the fronto-clypeal suture. Fronto-clypeal suture clearly depressed in its middle part. Clypeus moderately stretched forwards, convex transversely and longitudinally, with small, indistinct punctures; punctures on frons markedly smaller and more widely separated than those on clypeus. Mentum reversely trapezoidal, lateral margins flat, wide, lustrous, space in between opaque and convex transversely. Underside of neck strongly microreticulated, with a few not striking punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Not very wide, markedly convex transversely, slightly convex longitudinally. Lateral margins narrowing anteriorly, slightly bent. Hind corners slightly obtuse, front corners not projecting. Anterior margin very slightly excavated and somewhat protruded towards head in its middle. Lateral and anterior margins continuously bordered. Lateral borders visible in dorsal view, extremely narrow in the anterior half, slightly wider in the posterior half. Front corners in lateral view rectangular, hind corners with an angle of 100°. Surface laterally with distinct, small punctures, smaller towards the middle and less regularly set.

Scutellum: Triangular, with slightly bent sides.

Elytra: Elongate oval, strongly convex transversely, somewhat less convex longitudinally. Maximum height and width approximately in the middle. Shoulders slightly prominent. Apices of elytra mutually rounded. Lateral edges not visible in dorsal view. With distinct striae with small, elongate punctures; distance between punctures in stria 4 about 1–2 times diameter of a puncture; about 38 punctures in stria 4. Intervals very slightly convex, with minute, indistinct, not very closely set punctures.

Prosternum: Anterior margin continuously and narrowly bent upwards, in the middle retracted towards apophysis like a trough. Apophysis long, relatively narrow, protruded backwards, somewhat widened and raised along procoxae, space in between with a narrow, deep groove; margins behind coxae somewhat convergent and straight, slightly raised; apophysis straight apically, its ground markedly microreticulated.

Mesosternum: Hind part narrow; lateral margins somewhat raised; anterior margin excavated in the middle.

Metasternum: Anterior margin between mesocoxae narrowly rounded. Disc slightly convex, spaciously covered with tiny punctures which are the origin of very short, recumbent, tender hairs. Median line widely and deeply depressed in the posterior half.

Sternites: Anterior margin of sternite 1 between metacoxae narrowly ogival, bordered. No punctures are recognizable on sternites at 50-fold magnification, but there are short, widely separated, very thin, recumbent hairs.

Antennae: Of medium length, reaching slightly anterior to middle of elytra. Length/width ratio of antennomeres 1–11 equals to 16:5 / 7:4 / 16:4 / 10:4 / 10:4½ / 11:5½ / 10:5½ / 11:5½ / 10:5½ / 10:5½ / 15:5½.

Legs: Short. Femora thickened towards the second third. Pro- and mesotibiae straight; metatibiae straight in the basal half, incurved in the apical half. Lengths of protarsomeres 1–5 as 4:3:3:3:17, lengths of mesotarsomeres 1–5 as 12:8:6:5:16, lengths of metatarsomeres 1–4 as 38:11:6:15.

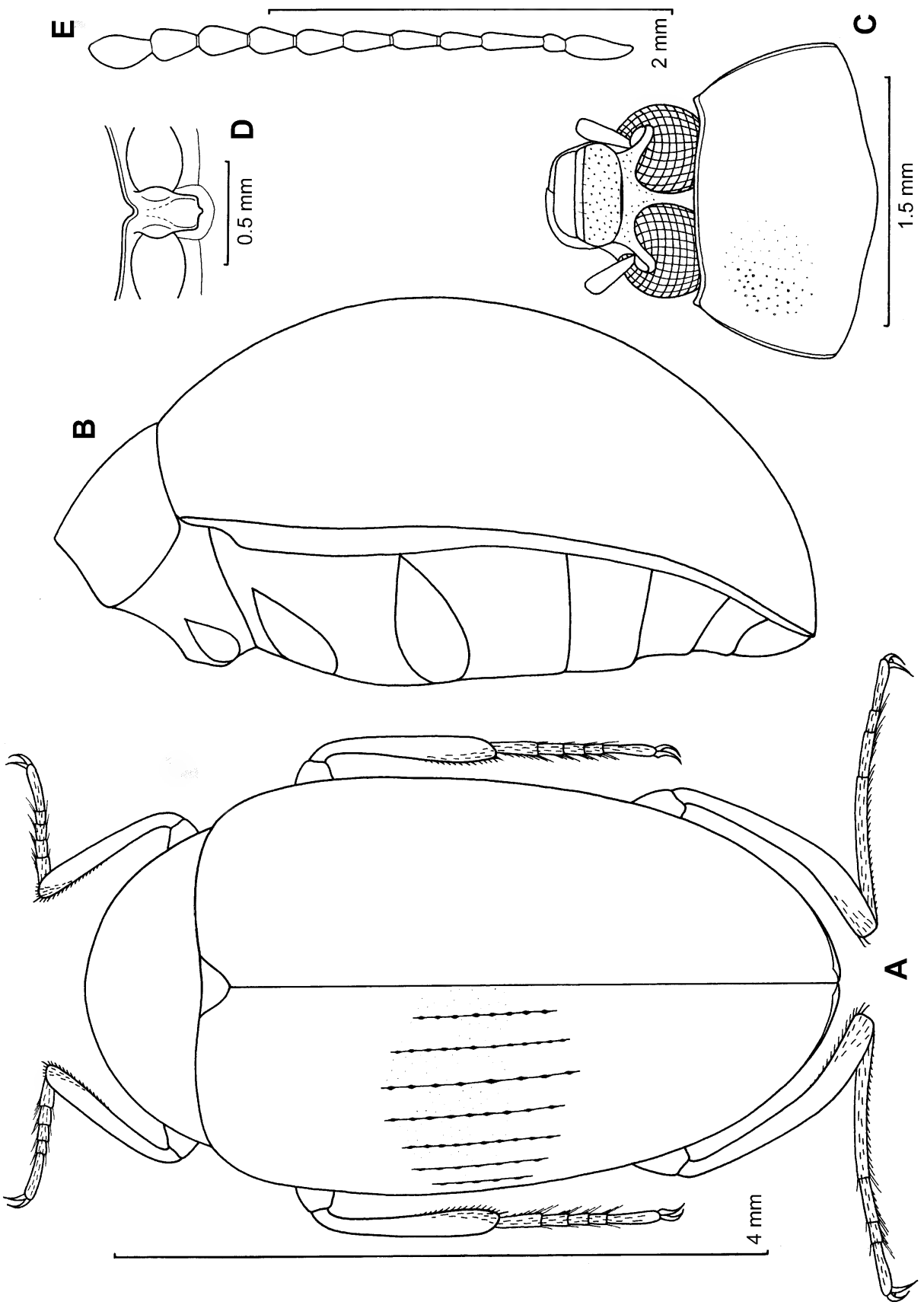


Fig. 53. *Amarygmus verecundus* n. sp. – **A** Habitus, ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna.

Amarygmus vespertinus **n. sp.**
(Fig. 54A–H)

Holotype (♂): Sabah, Keningau, 400 m, nachts, auf der Rinde von Bäumen, 19.II.2006, H. J. Bremer leg. (ZSMB).

Paratypes: Same data as holotype (1 ♂, 1 ♀ ZSMB). – Same data as holotype, but 17.II.2006 (1 ♂, 2 ♀♀ ZSMB; 1 ♂ BMNH). – Borneo, Malaysia, Sabah, Keningau, 17.–19.II.2006, R. Grimm (11 sex not determined CG). – Same data as before, but 10.II.2006 (7 sex not determined CG). – Same data as before, but 6.–7.II.2006 (1 ♂, 3 ♀♀, 9 sex not determined CG). – Same data as before, but 20.–22.III.2007 (3 ♂♂ CG, 1 ♂ ZSMB). – Borneo, Sabah, S Keningau, 350 m, 20.–22.III.2007, leg. W. Schawaller (1 ♂, 1 ♀ SMNS). – Nr. Keningau, Sabah, Borneo, 28.IV.1994 (1 ♀ CM). – Borneo, Malaysia, Sabah, 24 km NE Keningau (Apin Apin), 500 m, 18.II.2006, R. Grimm (3 sex not determined CG). – Malaysia, Sabah, 25 km NE Keningau, N Apin Apin, 25.XI.2006, R. Grimm (3 ♀♀ CG). – Sabah, 5 km NNE Apin Apin, 500 m, nachts, auf der Baumrinde, 18.II.2006, H. J. Bremer leg. (1 ♀ ZSMB). – Borneo, Malaysia, Sabah, Tenom, 300 m, 18.–19.III.2007, R. Grimm (2 ♂♂ CG, 1 ♂ ZSMB). – Sabah, Umg. Kudat, Bäume am Strand Bak Bak, nachts, auf der Baumrinde, 16.II.2006, Ulf Bremer leg. (1 ♀ ZSMB). – Borneo, Malaysia, Sabah, Kudat, Bak Bak, 14.–16.II.2006, R. Grimm (2 ♀♀ CG). – Same data as before, but 25.–26.III.2007 (1 ♂ CG).

Circumstances of collection: The majority of specimens have been collected on the bark of trees in gardens, parks or avenues, at night.

Etymology

Vespertinus (Lat.) = at evening.

Diagnosis

Small, narrow, elongate oval, markedly convex transversely. Upperside of elytra markedly lustrous, dark green, with reflections of the spectral colours; legs brown. Punctures of elytral rows small, closely set, rarely linked; elytral intervals flat, densely covered with minute, distinct punctures. Metatibiae strongly bent. Frons of medium width. Antennae of medium length. Males with short erect hairs on front of profemora and on back of meso- and metafemora. Male sternite 5 with a depression apicomedially.

Amarygmus vespertinus n. sp. resembles in size and shape, frontal width and shape and colouration of metatibiae *A. noctivagus* Bremer, 2005 (Bremer 2005a: 21–22) from northern Thailand. However, the pronotum of *A. noctivagus* is somewhat narrower, the pronotal punctures are smaller, the antennae are shorter, and the punctures of the elytral rows are always linked by thin lines.

A. proventus Bremer, 2002 (Bremer 2002a: 33) from the same area is also similar to *A. vespertinus*. However, in *A. proventus* the punctures on the elytral intervals are smaller and sparser, and the punctures of the elytral rows are larger.

With respect to shape and structure of the elytra *A. vespertinus* also resembles *A. jasarensis* Bremer, 2004 (Bremer 2004e: 116–117) from the Cameron Highlands of the Malayan Peninsula. However, in *A. vespertinus* the metatibiae are markedly and uniformly bent (straight in the basal half and slightly incurved in the apical half in *A. jasarensis*), and the elytrae show coloured reflections (absent in *A. jasarensis*).

Description

Measurements: Body length 4.16–4.63 mm; body width 2.33–2.68 mm. – Ratios: Pronotum: width/length 1.96–2.02; width hind corners/width front corners 1.74–1.82. Elytra: length/width 1.39–1.45; length elytra/length pronotum 3.62–3.78; maximum width elytra/maximum width pronotum 1.29–1.33.

Colouration: Upperside markedly lustrous, blackish green, with distinct, transverse reflections of the spectral colours. Femora, tibiae and tarsi brown. Antennomeres 1–5 light brown, 6–11 black (antennomere 11 apically brightened). Underside brown, lustrous. Underside of neck black, lustrous. Mentum and palpi light brown.

Head: Frons longitudinally somewhat convex, of medium width, as wide as length of antennomere 3. Genae narrow, short, slightly raised. Fronto-clypeal suture incised in the middle. Clypeus stretched forwards, somewhat convex transversely, with small, widely separated punctures which are the origin of short recumbent hairs. Frons similarly punctated as clypeus but without hairs. Mentum with bent lateral margins, diverging anteriorly, transition between lateral margins and base rounded, lateral margins with flat, wide margins, space in between transversely convex. Underside of neck slightly microreticulated, anteriorly with coarse, closely set punctures. Outer surface of mandibles with a sulcus, apically bifid.

Pronotum: Short, relatively narrow, uniformly convex transversely and longitudinally. Lateral margins narrowing anteriorly, bent. Front corners rounded. Anterior margin slightly excavated. Lateral and anterior margins bordered, lateral borders in dorsal view narrowly visible on the posterior three-fifths. Rounded front corners and angular hind corners slightly obtuse in lateral view. Surface with small, rather closely set punctures.

Scutellum: Triangular, impunctate.

Elytra: Elongate oval, the lateral outline following the outline of the pronotum, markedly convex transversely, also longitudinally relatively convex. Maximum width and height slightly behind level of the anterior third. Shoulders not prominent. Apices of elytra mutually rounded. Lateral edges not visible in dorsal view. With rows of small, closely set punctures which are rarely linked by thin lines on disc, changing to thin striae on the apical part of the elytra; distance between punctures on disc in row 4 about 1–1½ times diameter of a puncture; about 34 punctures in row 4. Intervals flat, with minute, distinct, rather closely set punctures.

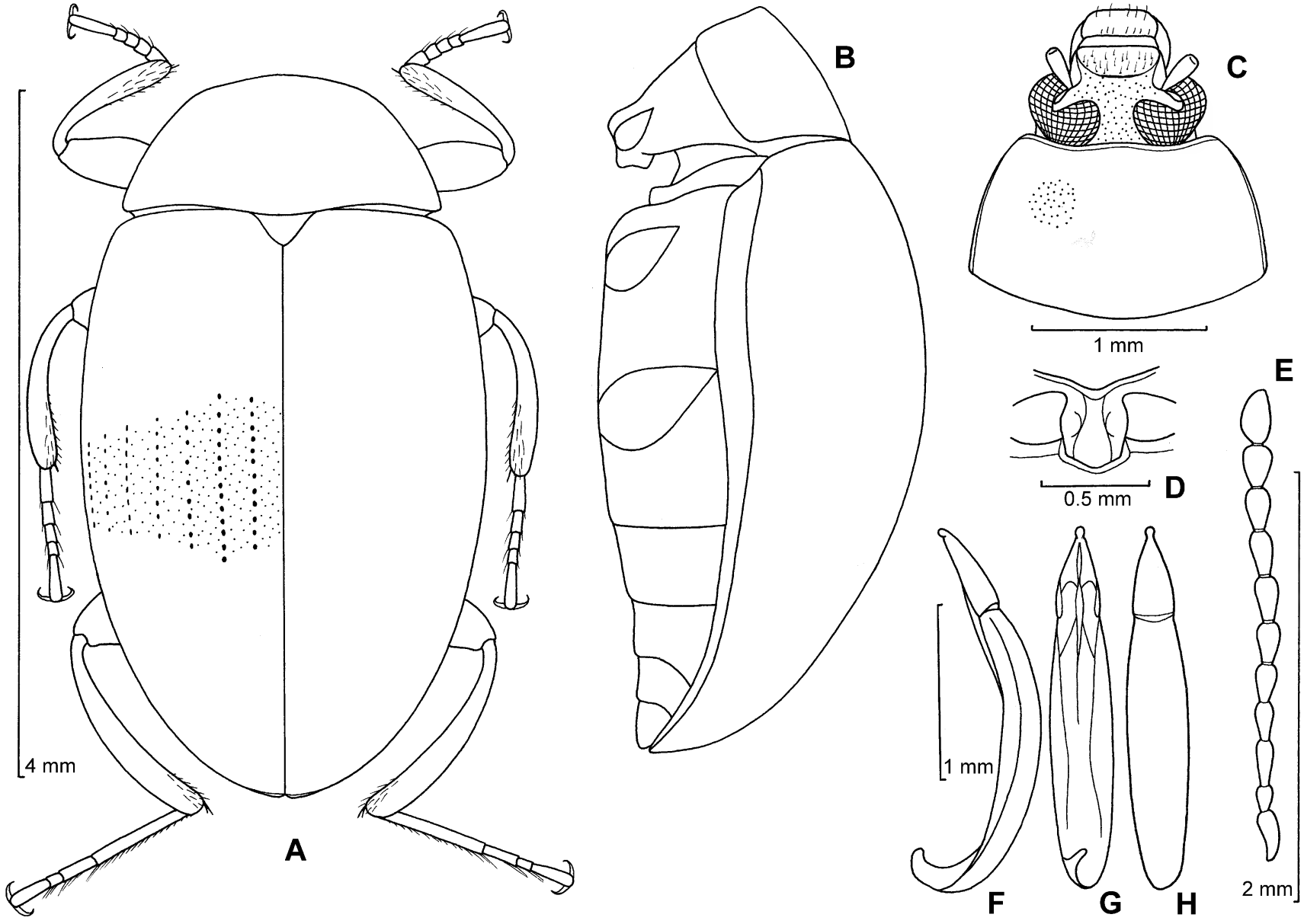


Fig. 54. *Amarygmus vespertinus* n. sp. – **A** Habitus. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna. **F** Aedeagus, lateral view. **G** Aedeagus, ventral view. **H** Aedeagus, dorsal view.

Prosternum: Anterior margin narrowly bent upwards, retracted towards apophysis in the middle. Apophysis plain, only slightly grooved in its middle; lateral margins slightly widened along procoxae, only very littles raised; margins posterior to coxae somewhat narrowing; lateral margins at the apex shortly retracted towards middle, widely rounded in the middle.

Mesosternum: Short. Anterior margin excavated in the middle.

Metasternum: Anterior margin between mesocoxae rounded, border outlined by a darkened margin. Just behind the margin there is a row of large punctures, otherwise disc with minute, widely separated punctures on its anterior half and tiny punctures on its posterior half; the punctures of the disc are the origin of semi-erect short hairs. Median line slightly incised in nearly its whole length.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, bordered; inner part of this border and borders behind metacoxae with coarse punctures. Sternites with tiny, widely separated punctures which are usually the origin of short semi-erect hairs.

Antennae: Not very long, reaching anterior third of elytra in males, somewhat shorter in females. Antennomere 11 rounded apically. Length/width ratio of antennomeres 1–11 in male equals to 10:4½ / 6:4 / 11:4 / 7:4½ / 8:5 / 8:5 / 10:6 / 10:6 / 10:6 / 9:6 / 12:6½, in female to 10:5 / 5½:4 / 9:4 / 6:4 / 7½:4½ / 8:5 / 9:5 / 9:6 / 9:6 / 8½:6 / 11:6½.

Legs: Short. Femora thickened towards the second third; front of profemora and back of meso- and metafemora in the basal three-fourths with short erect hairs. Protibiae very slightly bent, mesotibiae slightly bent, metatibiae distinctly bent and compressed. Protarsomeres 1–3 not widened in males. Lengths of protarsomeres 1–5 as 3:3:3:3:14, lengths of mesotarsomeres 1–5 as 8:5:4½:4:14, lengths of metatarsomeres 1–4 as 28:9:4:12.

Aedeagus: See Fig. 54F–H.

Amarygmus viduatus **n. sp.**
(Fig. 55A–E)

Holotype (♀): Borneo, Malaysia, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 10–200 m, 11.–14.IX.2008, Lux, R. Grimm (CG).

Paratype: Same data as holotype, but 23.–27.III.2009 (1 ♀ ZSMB).

Circumstances of collection: Edge of lowland primary forest, at light.

Etymology

Viduatus (Lat.) = widowed, isolated.

Diagnosis

Oblong, narrow, of medium size. Elytra widest just behind base, becoming slightly narrower posteriorly, with straight margins. Elytra with clearly incised striae with elongate punctures. Frons of medium width, antennae very short. Protibiae straight; mesotibiae very slightly bent on outer side; metatibiae nearly straight in the basal half, incurved in the apical half. Upperside blue, not very lustrous; legs dark brown to black.

Amarygmus viduatus n. sp. is very similar to *A. viridicatus* Bremer, 2004 (Bremer 2004a: 51, fig. 32) from Sabah. However, the legs of *A. viridicatus* are light brown (brownish black in *A. viduatus*), the mesotibiae are distinctly bent (only slightly bent in *A. viduatus*), and the fronto-clypeal suture is less strongly incised.

A. viduatus might turn out as a subspecies of *A. viridicatus*, but this can only be proved by the study of males (currently only females are known of both species).

Description

Measurements: Body length 5.41+5.65 mm; body width 2.63+2.68 mm. – Ratios: Pronotum: width/length 1.74+1.88; width hind corners/width front corners 1.70+1.71. Elytra: length/width 1.76+1.86; length elytra/length pronotum 3.62+3.64; maximum width elytra/maximum width pronotum 1.11+1.12.

Colouration: Upperside blue, opaque by microreticulation. Femora and tibiae brownish black, tarsomeres brown. Antennomeres 1–4 brown, 5 dark brown, 6–11 black. Underside brown, the last 2½ sternites dark brown.

Head: Frons of medium width, wider than length of antennomere 3 (like 12 : 9). Eyes very large, circumventing genae and roots of antennae. Genae narrow, anteriorly significantly surpassing the middle part of the fronto-clypeal suture. Fronto-clypeal suture markedly incised. Clypeus slightly stretched forwards, its sides becoming narrower anteriorly, convex longitudinally, with small, distinct punctures; punctures on frons smaller than those on clypeus. Mentum reversely trapezoidal, with slightly bent sides; lateral margins flat, strongly lustrous, space in between convex. Underside of neck covered with small, dense punctures. Mandibles on their outer surface with a longitudinal sulcus, apically bifid.

Pronotum: Not significantly wider than elytra, markedly convex transversely, moderately convex longitudinally. Lateral margins narrowing anteriorly, bent. Front corners not visible in dorsal view. Anterior margin nearly straight. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view visible only in the posterior half. Front and hind corners in lateral view rounded, clearly obtuse. Surface with small, distinct, relatively closely set punctures.

Scutellum: Triangular, with some tiny punctures.

Elytra: Elongate, markedly convex transversely, convex longitudinally. Maximum height at the level of the anterior third, widest just behind shoulders, narrowing with straight margins posteriorly. Shoulders prominent.

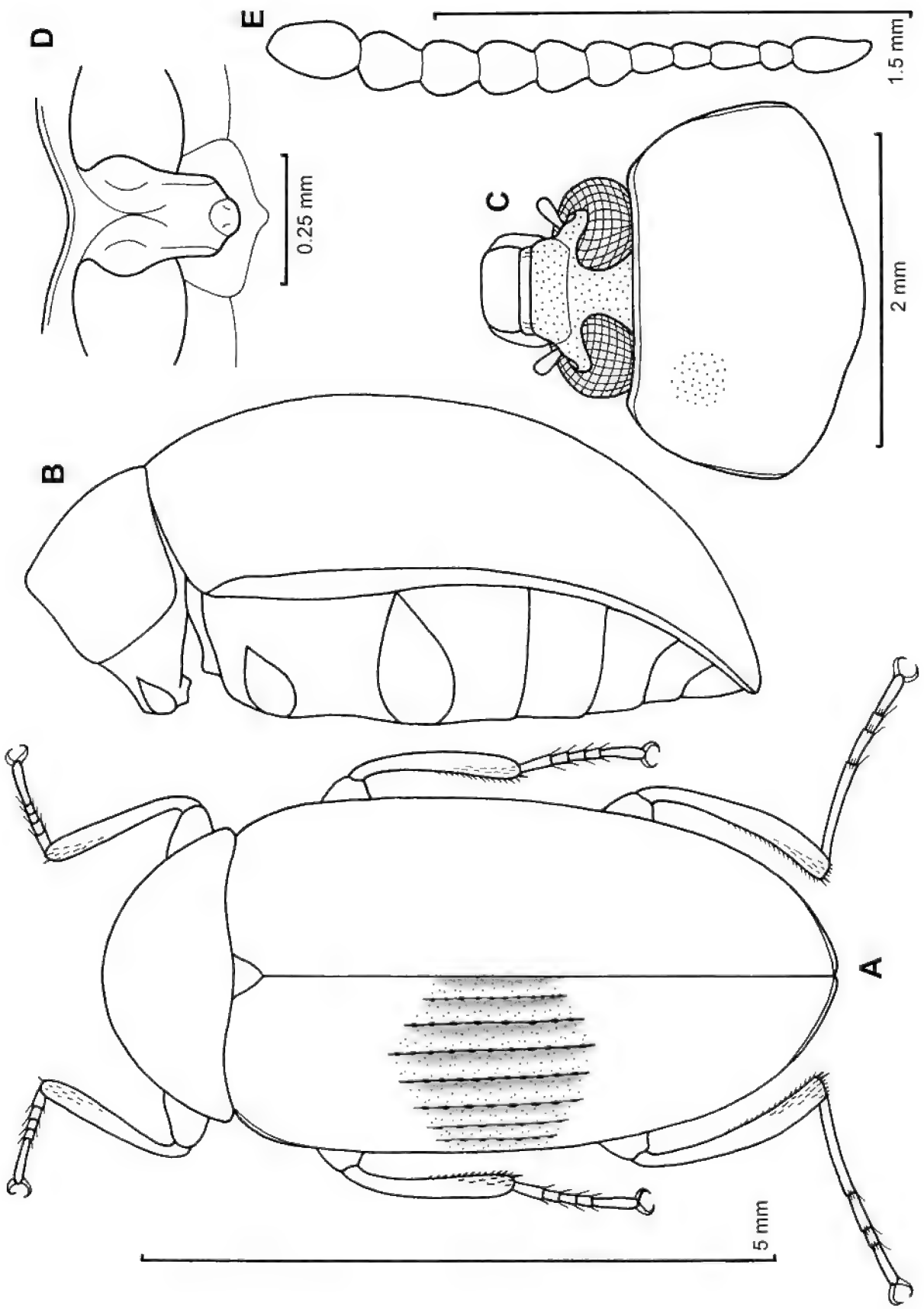


Fig. 55. *Amarygmus viduatus* n. sp. – **A** Habitus, ♀. **B** Body, lateral view. **C** Head and pronotum. **D** Prosternal apophysis. **E** Antenna.

Apices of elytra mutually rounded. Lateral edges not visible in dorsal view. With moderately incised striae with elongate punctures; distance between punctures on disc in stria 4 about 2–3 times diameter of a puncture. Intervals on disc very slightly convex, clearly convex laterally, with sparse, tiny punctures.

Prosternum: Anterior margin narrowly bent upwards. Apophysis narrow, margins along coxae widened and raised, space in between with a deep groove; apophysis subparallel posterior to coxae, apicomedially with a markedly raised tip.

Mesosternum: Hind part narrow; anterior margin excavated in the middle; excavation depressed posteriorly.

Metasternum: Anterior part of disc with two transverse rows of large punctures, posterior part with a few tiny punctures. Median line incised.

Sternites: Sternite 1 with a few small punctures, sternites 2–5 without punctures.

Antennae: Very short, reaching over base of elytra by about two antennomeres. Length/width ratio of antennomeres 1–11 equals to 9:5½ / 6:5 / 9:4 / 6:4½ / 6½:5 / 8:7½ / 8½:8½ / 8:8½ / 9:8½ / 9:8½ / 15:8½.

Legs: Short. Femora thickened towards the second third. Protibiae straight; mesotibiae slightly bent on outer side, straight on inner side; metatibiae nearly straight in the basal half, markedly incurved in the apical half. Lengths of protarsomeres 1–5 as 5:5:4:4:15, lengths of mesotarsomeres 1–5 as 11:7:5:5:17, lengths of metatarsomeres 1–4 as 34:12:8:17.

Amarygmus vilis **n. sp.**
(Fig. 56A–I)

Holotype (♂): Borneo, Malaysia, Sabah, Kinabalu NP, Poring vic., 380 m, 9.–11.III.2007, R. Grimm (CG).

Paratypes: Same data as holotype (1 ♂, 1 ♀ CG; 1 ♂, 2 ♀♀ ZSMB).

Circumstances of collection: Lowland primary forest, on tree bark, at night.

Etymology

Vilis (Lat.) = poor, humble.

Diagnosis

Small, oval. Elytra with rows of small punctures which are mostly linked by thin lines; intervals on disc flat, with minute, distinct punctures. Frons narrow, antennae short. Upperside dark copper-coloured, legs brown. Apical half of protibiae and protarsomeres 1–3 not widened in males.

A. cyclaeus n. sp. resembles *A. vilis* in size, structure of elytra and colouration. For the differences see under *A. cyclaeus*.

Description

Measurements: Body length 3.81–4.09 mm; body width 2.33–2.37 mm. – Ratios: Pronotum: width/length 1.96–2.00; width hind corners/width front corners 1.61–1.75. Elytra: length/width 1.38–1.40; length elytra/length pronotum 3.50–3.65; maximum width elytra/maximum width pronotum 1.26–1.32.

Colouration: Upperside (except scutellum) dark copper-coloured, moderately lustrous. Scutellum, underside and legs brown. Antennomeres 1–6 brown, 7–11 black.

Head: Frons narrow, its width corresponding to the diameter of two ocelli of the eyes. Genae somewhat raised, narrow, anteriorly terminating approximately at the level of the middle part of the fronto-clypeal suture. Fronto-clypeal suture strongly incised in the middle, weakly incised laterally, situated somewhat distant to the eyes. Clypeus moderately stretched forwards, somewhat convex transversely and longitudinally. Clypeus and frons on a microreticulated ground with small, irregularly set punctures. Mentum enlarged anteriorly, sides bent, lateral margins flat, lustrous, space in between transversely convex. Underside of neck markedly microreticulated, on its anterior part with some large, shallow punctures. Mandibles on their outer surface with a longitudinal sulcus, apically bifid.

Pronotum: Wide, convex transversely and longitudinally. Lateral margins narrowing anteriorly, bent. Anterior margin straight. Front corners depressed. Lateral and anterior margins continuously bordered. Lateral borders and front corners not visible in the anterior half. Front corners in lateral view narrowly rounded and slightly obtuse, hind corners angular and somewhat more obtuse. Surface with small, irregularly set punctures which are the origin of very short, semi-erect hairs (visible at 100-fold magnification).

Scutellum: Triangular, impunctate.

Elytra: Elongate oval, markedly convex transversely (particularly in the anterior part), less convex longitudinally. Maximum height and width at the level of the anterior third. Shoulders slightly prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view narrowly visible at the shoulders. With rows of small punctures which are linked by faint lines (best visible in oblique view); distance between punctures on disc 1–2 times diameter of a puncture; about 33 punctures in row 4. Intervals flat on disc, slightly convex latero-apically, with minute, distinct, moderately closely set punctures; very short hairs originating from the punctures (visible at 100-fold magnification).

Prosternum: Anterior margin narrowly bent upwards laterally, in the middle interrupted by a short, wide keel which is directed towards apophysis. Apophysis short, wide, margins along procoxae roundedly enlarged, space in between with a wide, shallow groove which is separated into two areas by a shallow median keel; posterior to coxae retracted towards apex which is slightly prominent in the middle.

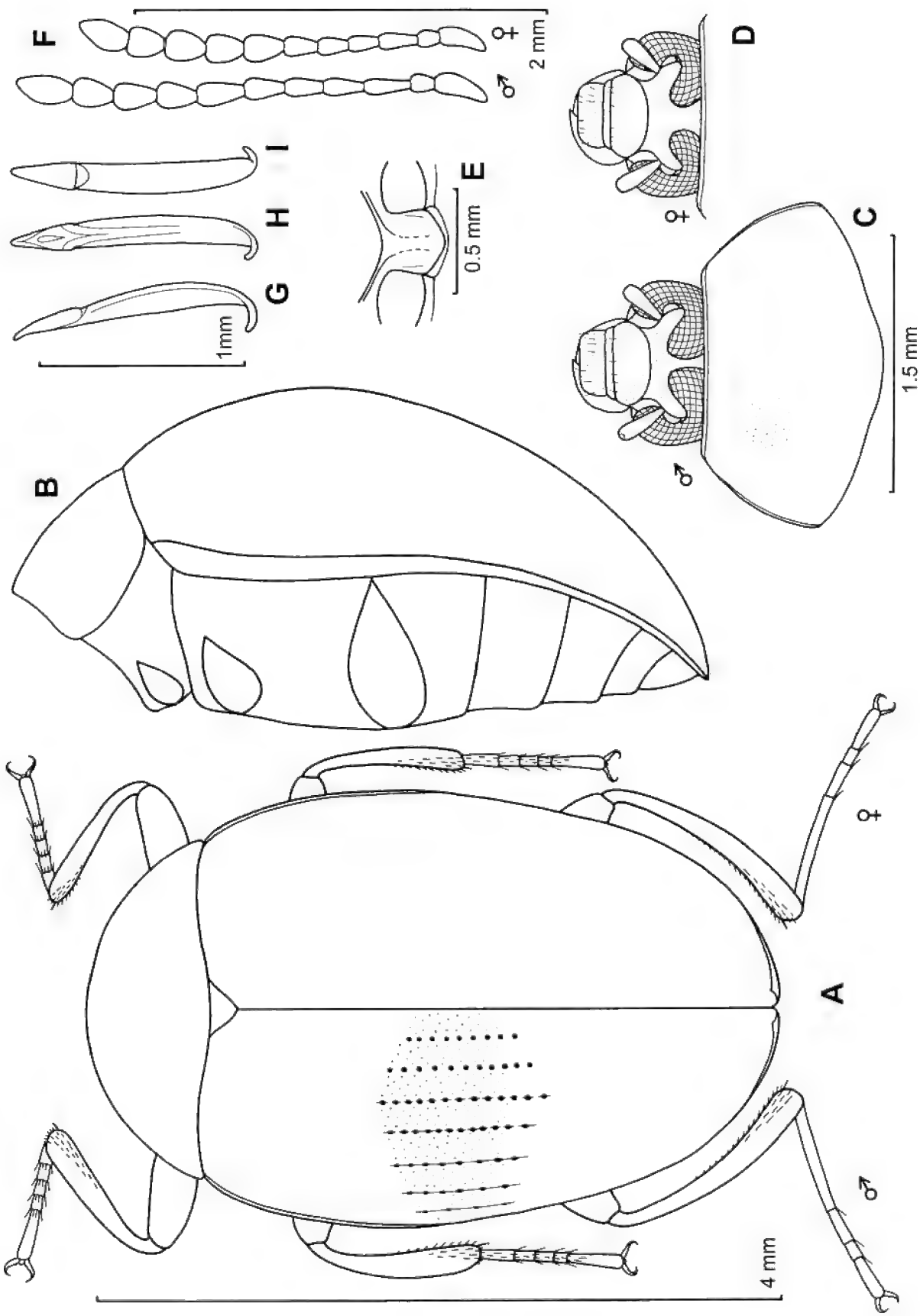


Fig. 56. *Amarygmus vilis* n. sp. – **A** Habitus; legs on left side ♂, right side ♀. **B** Body, lateral view. **C** Head and pronotum ♂. **D** Head ♀. **E** Prosternal apophysis. **F** Antennae ♂ and ♀. **G** Aedeagus, lateral view. **H** Aedeagus, ventral view. **I** Aedeagus, dorsal view.

Mesosternum: Hind part wide, short; anterior margin excavated in the middle.

Metasternum: Anterior margin between mesocoxae rounded, narrowly bordered. Disc slightly convex, anterior part with medium-sized, not very closely set punctures, posterior part with minute punctures; the punctures are the origin of short to medium-sized, semi-erect hairs. Median line translucent.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, narrowly bordered. Sternites with tiny, sparse punctures which are the origin of short, recumbent, tender hairs. Sternite 5 apicomedially not depressed in males.

Antennae: Rather short, reaching to anterior fourth of elytra, in females somewhat shorter than in males. Length/width ratio of antennomeres 1–11 in male equals to 13:5 / 6:5 / 12:4 / 9½:4½ / 9½:5 / 11:5 / 11:7 / 11:7 / 10:7 / 9:7 / 14:7, in female to 11:5 / 5½:4½ / 9:4 / 6½:4 / 7:4½ / 7:5 / 9:7 / 9½:7 / 9:7 / 8:7 / 13:7.

Legs: Short. Femora thickened towards the second third. Protibiae straight; meso- and metatibiae somewhat bent. Lengths of protarsomeres 1–5 as 4:4:4:4:14, lengths of mesotarsomeres 1–5 as 10:6:5½:5:16, lengths of metatarsomeres 1–4 as 30:11:6:12.

Aedeagus: See Fig. 56G–I.

Amarygmus viridis **n. sp.**
(Fig. 57A–E)

Holotype (♀): Borneo, Sabah W, Crocker Range W, W of Apin Apin, II.2000, M. Snižek leg. (ZSMB).

Etymology

Viridis (Lat.) = green.

Diagnosis

Of medium size, oval. Elytra with striae with elongate punctures. Frons rather narrow, antennae long. This species is especially characterized by the greenish blue colour of the elytra, the blue colour of the pronotum and the reddish brown legs and antennae.

A. viridis resembles in shape of pronotum and elytra *A. michaeli* Bremer, 2004 (Bremer 2004d: 138–139) from the same area. However, *A. michaeli* is smaller than *A. viridis* (body length 5.1 mm), the fronto-clypeal suture is incised in the middle (incised on the whole width of the head in *A. viridis*), the frons is wider, and the elytra are bluish violet (greenish blue in *A. viridis*).

A specimen in the collection of MNHN, labelled "type, *Amarygmus reductepurpureus* Pic", is very similar to *A. viridis*, but it has dark legs. *A. reductepurpureus* Pic is probably a species in litteris because I could not find a description.

Description

Measurements: Body length 6.69 mm; body width 4.22 mm. – Ratios: Pronotum: width/length 1.94; width hind corners/width front corners 1.79. Elytra: length/width 1.30; length elytra/length pronotum 3.83; maximum width elytra/maximum width pronotum 1.51.

Colouration: Frons greenish blue; genae brown; clypeus dark brown. Pronotum blue. Scutellum brown. Elytra greenish blue. Legs reddish brown. Antennomeres 1–5 reddish brown, 6–11 dark brown. Underside brown, slightly lustrous.

Head: Frons rather narrow, narrower than length of antennomere 4 (like 13 : 16). Genae short, slightly raised, anteriorly terminating just behind the middle part of the fronto-clypeal suture. Fronto-clypeal suture incised on the whole width of the head. Clypeus stretched forwards, slightly convex transversely and longitudinally, covered with small, shallow, moderately closely set punctures which are the origin of tiny recumbent hairs; punctures of frons similarly closely set but smaller. Mentum reversely trapezoidal, lateral margins wide, flat, lustrous, space in between opaque and convex transversely. Outer surface of mandibles with a longitudinal sulcus, apically bifid.

Pronotum: Wide, moderately convex transversely and longitudinally. Lateral margins narrowing anteriorly, bent. Anterior margin markedly excavated. Front corners narrowly rounded; hind corners wider rounded. Lateral and anterior margins continuously bordered. Lateral borders in dorsal view visible. Front corners in lateral view rounded, obtuse, hind corners more obtuse. Surface with minute to small, irregularly and not very closely set punctures.

Scutellum: Triangular, with some tiny punctures.

Elytra: Widely oval, convex transversely and longitudinally. Maximum width and height somewhat anterior to the middle. Shoulders not very prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view nearly entirely visible. With superficial but distinct striae which are intermittently widened by elongate, small punctures; distance between punctures on disc in stria 4 about ½–1 times diameter of a puncture; about 30 punctures in stria 4. Intervals flat, slightly convex latero-apically, with tiny, sparse punctures.

Prosternum: Anterior margin continuously and narrowly bent upwards, retracted towards apophysis in the middle. Apophysis wide, not very long; lateral margins along procoxae widened and raised, space in between with a wide, shallow groove; obtuse-angled apically; ground of the apophysis microreticulated, with hairs of medium length which are partially erect or recumbent.

Mesosternum: Anterior margin excavated in the middle; lateral to the excavation somewhat lifted like a roll; surface with nondirectional hairs of medium length.

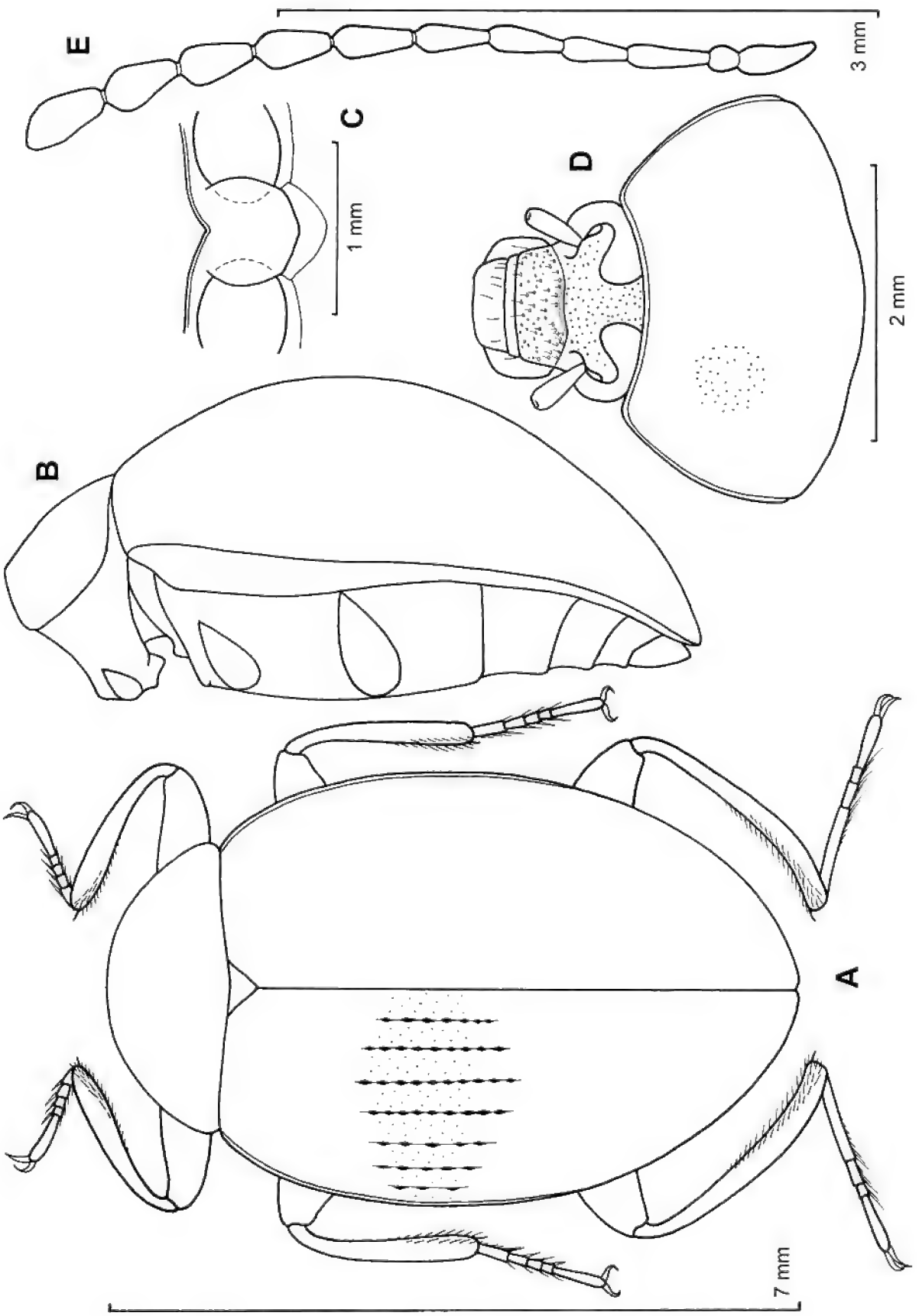


Fig. 57. *Amarygmus viridis* n. sp. – **A** Habitus. **B** Body, lateral view. **C** Prosternal apophysis. **D** Head and pronotum. **E** Antenna.

Metasternum: Anterior part of disc with coarse punctures which are the origin of semi-erect hairs of medium length, posterior part with tiny, widely separated punctures. Median line translucent.

Sternites: Anterior margin of sternite 1 between metacoxae widely ogival, bordered. Sternites with tiny, widely separated punctures and with tiny hairs.

Antennae: Of medium length, reaching slightly anterior to middle of elytra. Antennomere 11 rounded apically. Length/width ratio of antennomeres 1–11 equals to 21:9 / 9:7½ / 20:6½ / 16:7 / 18:7 / 19:7 / 19:9 / 18:10 / 19:10 / 18:10 / 22:10.

Legs: Of medium length. Femora somewhat thickened towards the second third. Protibiae straight on outer side, somewhat widened apically on inner side. Mesotibiae straight on inner side, slightly bent on outer side. Metatibiae widened apically, somewhat incurved in the apical half. Lengths of protarsomeres 1–5 as 6:6:6:5:27, lengths of mesotarsomeres 1–5 as 13:9:7:6:27, lengths of metatarsomeres 1–4 as 36:12:11:26.

Amarygmus votivus **n. sp.**
(Fig. 58A–I)

Holotype (♂): Borneo, Malaysia, Sabah, Crocker Mts., Gunung Emas, 1600 m, 13.V.2005, R. Grimm (CG).

Paratypes: Malaysia, Sabah Prov., Banjaran Crocker Mts., Gunung Alab peak, 1650–1800 m, 30.IV.–27.V.1996, M. Štrba & R. Hergovits leg. (1 ♀ ZSMB). – Borneo, Malaysia, Sabah, Crocker Range, Gunung Emas, 1500 m, 16.–21.III.2007, R. Grimm (1 ♀ ZSMB).

Circumstances of collection: Mountainous primary forest, on tree bark, at night (leg. R. Grimm).

Etymology

Votivus (Lat.), epithet = welcome, desirable.

Diagnosis

Small, oval, markedly convex, strongly shiny. Elytra blue laterally, disc copper-coloured, pronotum greenish golden. Elytra with rows of medium-sized punctures, distance between punctures irregular; intervals flat, only with a few tiny punctures. Frons relatively narrow. Antennae of medium length, in male longer than in female. Male protarsomeres 1–3 not widened.

A. cinaediae Bremer, 2004 (Bremer 2004e: 107–109) from Sarawak and Sumatra is of similar size and shows also a blue frame on the elytra. However, *A. cinaediae* has a wider frons, the pronotal front corners are slightly acute-angled (rounded in *A. votivus*), the punctures of the elytral rows are larger and linked by faint lines at least laterally, and the maximum elytral width and height is approximately in its middle (maximum height clearly anterior to the middle in *A. votivus*).

Other species with a blue or violet colour of the lateral parts of the elytra are *A. jenisi* Bremer, 2004 and *A. affectus* n. sp., but these species are smaller than *A. votivus*. For additional characters see under *A. affectus*.

Description

Measurements: Body length 5.65–5.98 mm; body width 3.57–3.78 mm. – Ratios: Pronotum: width/length 2.00–2.02; width hind corners/width front corners 1.89–1.94. Elytra: length/width 1.28–1.35; length elytra/length pronotum 3.37–3.68; maximum width elytra/maximum width pronotum 1.31–1.39.

Colouration: Upperside and underside clearly lustrous. Frons and clypeus greenish blue. Pronotum greenish golden. Lateral parts of elytra blue, disc copper-coloured. Underside brown. Femora brown, tibiae dark brown, tarsi light brown. Antennomeres 1–6 brown, 7 dark brown, 8–11 black.

Head: Frons moderately wide, in male slightly wider than in female; relation width of frons/length of antennomere 4 in male 10 : 13, in female 13 : 10. Genae short, somewhat raised, anteriorly terminating behind the level of the middle part of the fronto-clypeal suture. Fronto-clypeal suture distinctly but narrowly incised in its middle part, only slightly incised in its lateral part. Clypeus moderately stretched forwards, very slightly convex transversely and longitudinally. Clypeus and frons with minute, widely separated punctures. Mentum wide, reversely trapezoidal, lateral margins flat, space in between convex transversely. Underside of neck with rather closely set, shallow punctures of medium size. Outer surface of mandibles with a longitudinal sulcus, apically bifid.

Pronotum: Wide, uniformly convex transversely, slightly convex longitudinally. Lateral margins anteriorly narrowing, bent. Anterior margin somewhat excavated. Front corners rounded. Lateral and anterior margins bordered. Lateral borders in dorsal view very narrowly visible in their whole length. Front and hind corners in lateral view obtuse. Surface with minute, widely separated punctures.

Scutellum: Triangular, with a few tiny punctures.

Elytra: Widely oval, distinctly convex transversely and longitudinally. Maximum height at the level of the anterior third, maximum width somewhat anterior to the middle. Shoulders slightly prominent. Apices of elytra mutually rounded. Lateral edges in dorsal view very narrowly visible. With rows of small punctures which are not linked by lines; distance between punctures on disc in row 4 irregular, about 1½–4 times diameter of a puncture; about 28 punctures in row 4. Intervals flat, with tiny, widely separated punctures.

Prosternum: Anterior margin continuously bent upwards, somewhat retracted towards apophysis in the middle. Apophysis wide, short, lateral margins along

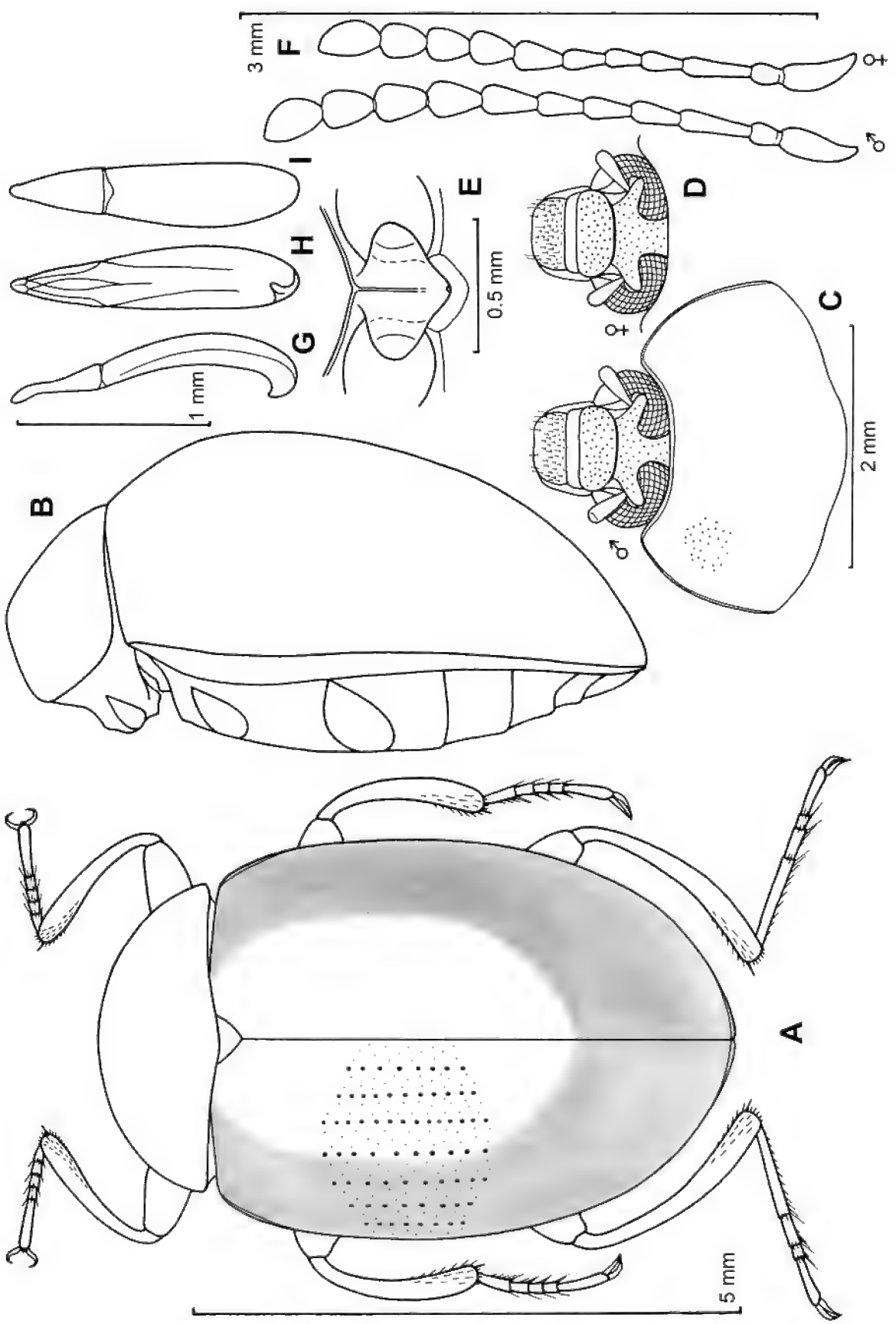


Fig. 58. *Amarygmus votivus* n. sp. – **A** Habitus, ♂ (shaded area of elytra blue). **B** Body, lateral view. **C** Head and pronotum ♂. **D** Head ♀. **E** Prosternal apophysis. **F** Antennae ♂ and ♀. **G** Aedeagus, lateral view. **H** Aedeagus, ventral view. **I** Aedeagus, dorsal view.

procoxae widened, raised, nearly wing-shaped; space in between with a shallow groove, interrupted in the middle by a narrow, low keel which extends across almost the whole apophysis; margins markedly narrowing posterior to coxae; apically broadly pointed.

Mesosternum: Hind part wide; anterior margin widely, almost triangularly excavated in the middle.

Metasternum: Anterior margin between mesocoxae rounded, bordered. Anterior part of disc with sparse, small punctures, posterior part with minute punctures; disc bare in male. Median line neither depressed nor incised.

Sternites: Anterior margin of sternite 1 between metacoxae ogival, bordered. Sternites bare in both sexes, with tiny, sparse punctures. Sternite 5 without apicomedial depression in males.

Antennae: Not very long, reaching to about anterior two-fifths of elytra in male and about anterior third in female. Length/width ratio of antennomeres 1–11 in male equals to 16:7 / 9:6 / 19:5½ / 13:6 / 12:6 / 11:6 / 16:8 / 14:9 / 14:9 / 13:9 / 16:9, in female to 14:7 / 8:6 / 18:6 / 11:6 / 11:6 / 10:6 / 13:8 / 13:9 / 12:9 / 12:9 / 16:9.

Legs: Short. Femora distinctly thickened towards the second third. Protibiae slightly bent; mesotibiae more bent than protibiae, pro- and mesotibiae thickened apically; metatibiae slightly incurved in the apical half. Lengths of protarsomeres 1–5 as 6:6:6:6:21, lengths of mesotarsomeres 1–5 as 12:8:6:6:21, lengths of metatarsomeres 1–4 as 34:12:7:21.

Aedeagus: See Fig. 58G–I.

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New and little known species of Tenebrionidae (Coleoptera) from Borneo

Roland Grimm

Abstract

The following new species are described: *Platydema omissum* **n. sp.** (E Malaysia/Sabah and Sarawak, W Malaysia, Vietnam, Indonesia), *P. castaneum* **n. sp.** (E Malaysia/Sarawak), *P. castaneoides* **n. sp.** (E Malaysia/Sarawak), *P. santubongicum* **n. sp.** (E Malaysia/Sarawak), *P. thijlberti* **n. sp.** (E Malaysia/Sarawak), *Spiloscapha medvedevi* **n. sp.** (E Malaysia/Sarawak), and *S. bakeri* **n. sp.** (E Malaysia/Sabah). New combination and synonym: *Guanobius antricola* (Blair, 1936) **n. comb.** from *Tenebrio* = *Guanobius borneensis* Grimm, 2008 **n. syn.** *Taiwanocryphaeus erberi* Schawaller, 2005, *Platydema javanum* Kaszab, 1979, *P. nuciferae* Blair, 1928, *P. pentaphylloides* Kaszab, 1980, *P. unicornis* Gebien, 1927, *Derispia batuica* Schawaller, 2005, and *D. titschacki* Kaszab, 1946 are reported for the first time from Borneo. New records of *Toxicum moultoni* Gebien, 1914 are given. *Platydema latemarginatum* Gebien, 1927 from Sumatra is a valid species and not a synonym of *P. sericeum* Gebien, 1914 from Thailand, W Malaysia, Singapore, Sumatra, Mentawei, and Borneo.

Keywords: Tenebrionidae, Borneo, Malaysia, Sabah, Sarawak, Toxicini, Alphitobiini, Diaperini, Leiochrinini, new species, new records, synonymy.

Zusammenfassung

Die folgenden neuen Arten werden beschrieben: *Platydema omissum* **n. sp.** (Ost-Malaysia/Sabah und Sarawak, West-Malaysia, Vietnam, Indonesien), *P. castaneum* **n. sp.** (Ost-Malaysia/Sarawak), *P. castaneoides* **n. sp.** (Ost-Malaysia/Sarawak), *P. santubongicum* **n. sp.** (Ost-Malaysia/Sarawak), *P. thijlberti* **n. sp.** (Ost-Malaysia/Sarawak), *Spiloscapha medvedevi* **n. sp.** (Ost-Malaysia/Sarawak) und *S. bakeri* **n. sp.** (Ost-Malaysia/Sabah). Neue Kombination und neues Synonym: *Guanobius antricola* (Blair, 1936) **n. comb.** von *Tenebrio* = *Guanobius borneensis* Grimm, 2008 **n. syn.** *Taiwanocryphaeus erberi* Schawaller, 2005, *Platydema javanum* Kaszab, 1979, *P. nuciferae* Blair, 1928, *P. pentaphylloides* Kaszab, 1980, *P. unicornis* Gebien, 1927, *Derispia batuica* Schawaller, 2005 und *D. titschacki* Kaszab, 1946 werden erstmals für Borneo nachgewiesen. Neue Funde von *Toxicum moultoni* Gebien, 1914 werden mitgeteilt. *Platydema latemarginatum* Gebien, 1927 aus Sumatra wird als eigene Art betrachtet und nicht als Synonym von *P. sericeum* Gebien, 1914 aus Thailand, W Malaysia, Singapore, Sumatra, Mentawei und Borneo.

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1 Introduction

Tenebrionidae from Borneo have been described or recorded in several contributions, but the species inventory is far from complete. The author's fieldwork in northern Borneo (Sabah, Sarawak) between 2005 and 2009 yielded numerous new species and additional records. Some of them are described and communicated in this paper. Specimens from several collections (see list below) were used for comparison.

The examination of *Platydema* species indicated that *P. sericeum* Gebien, 1914 in the sense of Schawaller (2004) consists of three different species.

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Acronyms of depositories

BMNH	The Natural History Museum, London, United Kingdom (Max Barclay, Beulah Garner)
CKA	Collection Dr. Kiyoshi Ando, Osaka, Japan
CRG	Collection Dr. Roland Grimm, Tübingen, Germany
HNHM	Hungarian Natural History Museum, Budapest, Hungary (Dr. Ottó Merkl)
NHMB-F	Naturhistorisches Museum Basel, Collection Frey, Switzerland (Dr. Eva Sprecher)
SDEI	Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany (Dr. Lothar Zerche)
SMNS	Staatliches Museum für Naturkunde, Stuttgart, Germany (Dr. Wolfgang Schawaller)
ZSM	Zoologische Staatssammlung, München, Germany (Dr. Michael Balke)

2 Taxonomy

2.1 Tenebrioninae Latreille, 1802

Toxicini Lacordaire, 1859

Toxicum moultoni Gebien, 1914

Type material studied

Borneo, Kuching, 25.X.[18]99, (Moulton), Type! No 297, holotype (labelled as type) (NHMB-F).

Additional material studied

Borneo, Malaysia, Sarawak, Gunung Gading National Park, 100–250 m, 9.–12.III.2008, R. Grimm leg., 3 ♀♀ (CRG). – Borneo, Malaysia, Sarawak, Kubah National Park, 250 m, 18.–19.III.2008, R. Grimm leg., 1 ♀ (CRG). – Borneo, Malaysia, Sarawak, Kubah National Park, 100–300 m, 15.–18.IX.2008, R. Grimm leg., 2 ♀♀ (CRG).

Distribution

Sarawak.

Remarks

So far only females of this distinctive species are known. The study of the holotype revealed that it is also a female, and not a male as it was stated by Gebien (1914), presumably because of the distinct horns on the head.

Taiwanocryphaeus erberi Schawaller, 2005

Material studied

Borneo, Malaysia, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 10–200 m, 11.–14.IX.2008, R. Grimm leg., 1 ♂ (CRG).

Distribution

Sumatra (Schawaller 2005b), Borneo (new record).

Alphitobiini Reitter, 1917

Guanobius antricola (Blair, 1936) **n. comb.**

Tenebrio antricola Blair, 1936.
Guanobius borneensis Grimm, 2008 **n. syn.**

Type material studied

Tenebrio antricola Blair, 1936: Java, Babakan, III.1933, Dammerman leg., holotype (labelled as type) (BMNH).

Guanobius borneensis Grimm, 2008: Borneo, Malaysia, Sabah, Sandakan, Gomantong Caves, 13.III.2007, R. Grimm leg., holotype and 67 paratypes (CRG).

Additional material studied

Malaysia, Sarawak, 4th Division, Gunung Mulu National Park, Deer Cave, 12.V.1978, P. M. Hammond & J. E. Marshall leg., BM 1978-49, 4 specimens (BMNH).

Distribution

Borneo, Java.

Remarks

Blair (1936) described the cave-dwelling *Tenebrio antricola* from Java and Borneo and Grimm (2008) described *Guanobius borneensis* from caves in Sabah and Sarawak. Comparison of the types revealed that *G. borneensis* is a synonym of *T. antricola*. The species does not belong to the genus *Tenebrio* Linnaeus, 1758 (Tenebrionini) as Blair (1936) assumed, but to the genus *Guanobius* Grimm, 2008 (Alphitobiini). For phylogenetic discussion see Grimm (2008). Consequently *Tenebrio antricola* Blair, 1936 is *Guanobius antricola* (Blair, 1936) n. comb.

2.2 Diaperinae Latreille, 1802

Diaperini Latreille, 1802

Platydema sericeum Gebien, 1914
(Figs. 14, 21)

Type material studied

Banguey near Borneo, ♂ holotype, 1 ♀ paratype (labelled as types) (NHMB-F); 2 ♂♂, 1 ♀ paratypes (labelled as cotypes) (NHMB-F); 1 ♀ paratype (labelled as cotype) (HNHM).

Additional material studied

Banguey, Staudinger, 2 specimens (ZSM). – Malaysia, Johor, Endau–Rompin, Selendang, 1.–4.III.1997, I. Jeniš leg., 1 specimen (SMNS). – Singapore, C. J. Saunders leg., BM 1933-227, 1 specimen (BMNH). – Banguey near Borneo, 2 specimens (SMNS). – Borneo, Malaysia, Sarawak, Kubah National Park near Matang Wildlife Centre, 50–100 m, 28.–31.III.2009, R. Grimm leg., 10 specimens (CRG). – Same data as before, but 19.–22.IX.2008, 4 specimens (CRG). – Borneo, Malaysia, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 10–200 m, at light, 11.–14.IX.2008, R. Grimm leg., 1 specimen (CRG). – Borneo, Malaysia, Sarawak, 10 km SE Lundu, 31.III.2009, R. Grimm

leg., 9 specimens (CRG). – Borneo, Malaysia, Sabah, Apin Apin, 350–380 m, 6.II.2006, H. J. Bremer & R. Grimm leg., 10 specimens (CRG). – N Borneo, 1 specimen (SDEI). – Mentawei, Si Oban, IV.–VIII.[18]94, 1 specimen (SDEI ex coll. Kraatz). – Sumatra, Prov. Aceh-Selatan, Babahrot, 100 m, 15.–18.VII.1983, J. Klapperich leg., 2 specimens (HNHM). – S Thailand, 8 km S Khao Lak, 08°36'36"N 98°14'61"E, env. Merlin Resort, 30.VII.–11.VIII.2007, A. Skale leg., 1 specimen (CRG).

Distribution

Thailand, W Malaysia, Singapore, Sumatra, Mentawei, E Malaysia (Sabah, Sarawak).

Remarks

Not only the left horn of the males is furnished with hairs, but also the left cephalic tubercle of the females often has a small apical hair-brush.

The material listed by Schawaller (2004) under *P. sericeum* contains, besides *P. sericeum* and *P. latemarginatum* Gebien, a new species, which is described below as *P. omissum* n. sp. Further remarks see under *P. latemarginatum*.

Platydema latemarginatum Gebien, 1927
(Figs. 1, 1a, 20)

Type material studied

Sumatra, Fort de Kock, C. Jacobson leg., ♂ holotype (labelled as type), 2 ♀♀ paratypes (labelled as cotypes) (NHMB-F); 1 ♂ paratype (HNHM). – Sumatra, Fort de Kock, 920 m, 1925, C. Jacobson leg., 1 ♂, 1 ♀ paratypes (labelled as cotypes) (SDEI).

Additional material studied

Sumatra, Fort de Kock, C. Jacobson leg., 1 ♂, 1 ♀ (ZSM); 1 ♂ (HNHM).

Distribution

Sumatra, so far only known from the type locality.

Remarks

According to Schawaller (2004) *P. latemarginatum* Gebien, 1927 is a synonym of *P. sericeum* Gebien, 1914, because of the somewhat similar shape of the apicale of the aedeagus (compare Figs. 20, 21). However, *P. sericeum* is smaller in size (body length 3.3–3.8 mm), the colouration of pronotum and elytra is reddish-brown with blackish patches (usually a longitudinal one on each elytron), and the tip of the bulbous larger left horn of the males is broadly rounded and bears a tuft of longer hairs (Fig. 14). *P. latemarginatum* is larger in size (body length 4.2–5.2 mm), the general colouration of pronotum and elytra is blackish-brown with the lateral parts of elytra brown, and the horns of the males are both conical to subcylindrical (Figs. 1, 1a) with a short hairy brush apically (cf. Schawaller 2004: fig. 172, under *P. sericeum*). As already pointed out by Gebien (1927) the male vertex of *P. latemarginatum* has a deep pit (Fig. 1a) which is visible only as a small slit in normal position of the head. This is a character, that seems to distinguish *P. latemarginatum* from any other species of *Platydema*. Thus, *P. latemarginatum* is regarded as a valid species and not as a synonym of *P. sericeum*.

Platydema omissum **n. sp.**
(Figs. 2, 2a, 13, 17, 22, 23)

Holotype: ♂, Borneo, Malaysia, Sarawak, Kubah National Park, near Headquarter, 100–300 m, 27.–28.III.2009, R. Grimm leg. (CRG).

Paratypes: Same data as holotype, 5 ♂♂, 5 ♀♀ (CRG). – Borneo, Malaysia, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 10–200 m, 27.–28.IX.2008, R. Grimm leg., 2 ♂♂ (CRG). – Borneo, Malaysia, Sarawak, Gunung Gading National Park, 100–300 m, 31.III.–4.IV.2009, R. Grimm leg., 4 ♂♂ (CRG). – Borneo, Malaysia, Sarawak, Kubah National Park, near Matang Wildlife Centre, 19.–22.IX.2008, R. Grimm leg., 1 ♀ (CRG). – Borneo, Malaysia, Sabah, Apin Apin, 350–380 m, 6.II.2006, H. J. Bremer & R. Grimm leg., 5 ♂♂, 1 ♀ (CRG). – E. Malaysia, Sarawak, Sebadai Park, 9 km SW Kapit, 50 m, 20.V.1994, secondary mixed Dipterocarp forest, Löbl & Burkhard leg., 1 ♂ (SMNS). – Borneo, Sabah, Kampung Takala, Kinabatangan river, 5.VI.1998, Kodada & Čiampor leg., 1 ♀ (SMNS). – W Malaysia, Pahang, Kampung Tahan, 04°23'N 102°24'E, 20.–27.VII.2004, R. & H. Fouquè leg., 4 ♂♂ (SMNS). – Indonesia, Nias eastern coast, Lawalo, 26.IX.1979, Erber leg., 2 ♂♂, 7 ♀♀ (SMNS); 1 ♂, 2 ♀♀ (HNHM). – Lombok Is., Sabito, 29.–30.IV.1986, M. Nishikawa leg., 1 ♂, 1 ♀ (SMNS). – S Sumatra, Lampung Prov., Bukit Barisan, Selata National Park, 5°4'S 104°4'E, 600 m, 5 km SW Liwa, 7.–17.II.2000, D. Hauck leg., 1 ♂ (ZSM). – Malacca, C. Müller leg., 1 ♂ (ZSM). – Malacca, 1 ♂ (ZSM). – Mentawei, Si Oban, IV.–VIII.[18]94, Modigliani leg., 1 ♂, 1 ♀ (SDEI). – Sumatra, Prov. Aceh-Selatan, Babahrot, 100 m, 15.–18.VII.1983, J. Klapperich leg., 1 ♂ (HNHM). – Vietnam, 25 km W Thai Nguyen, 2.XI.1976, L. Medvedev leg., 1 ♂ (HNHM).

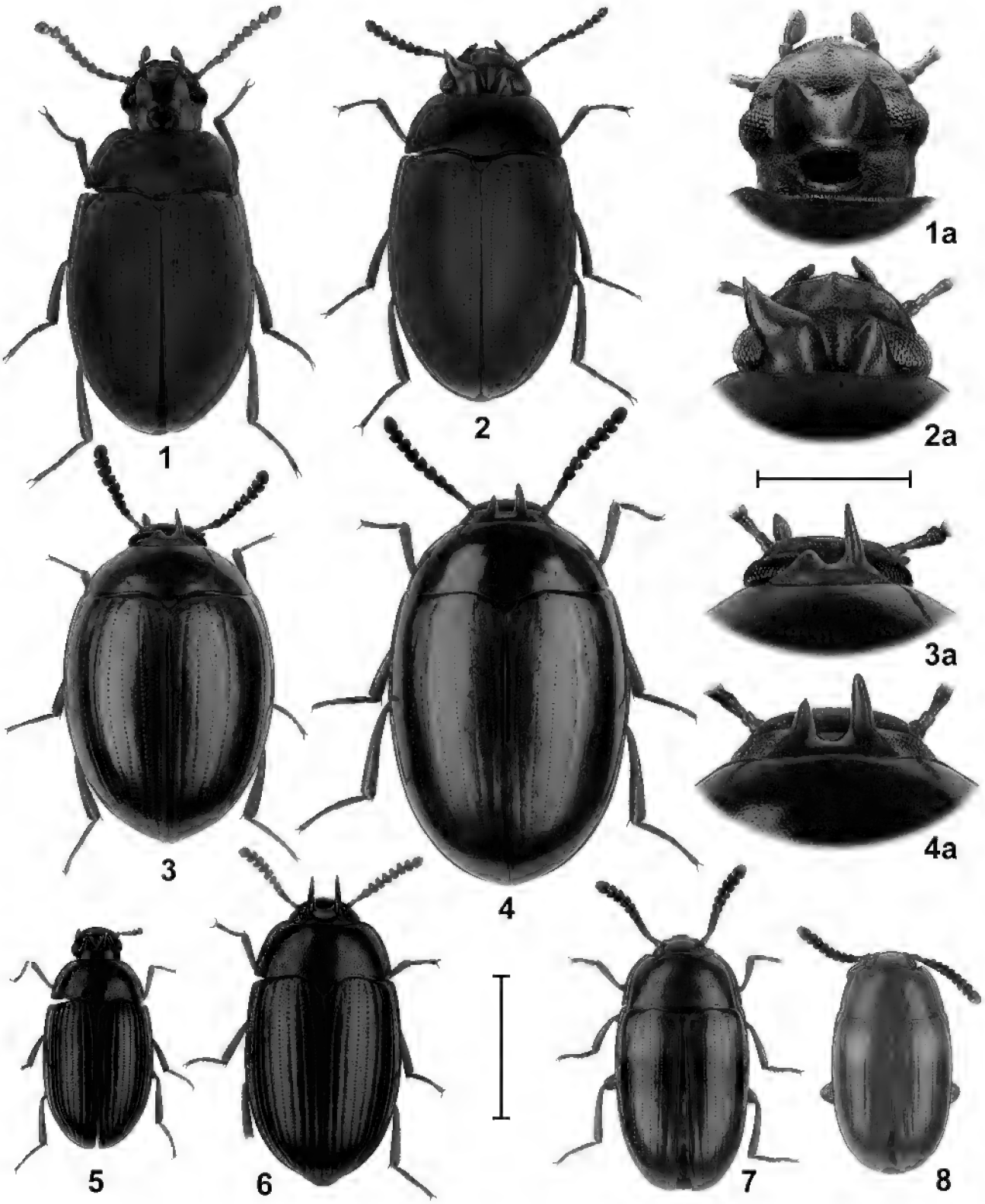
Etymology

Omittere (Lat.) = to omit.

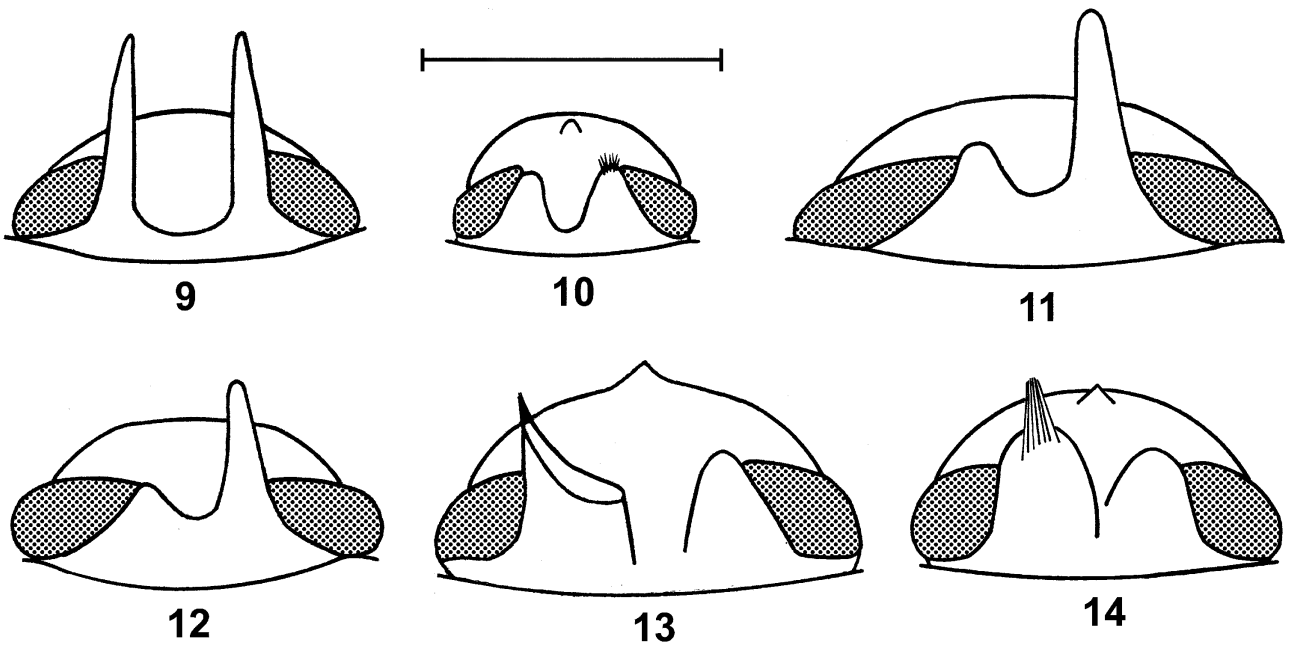
Description

Oval, body length 3.4–5.0 mm, body width 1.8–2.8 mm. Dorsal side reddish-brown to dark brown, pronotum and elytra with blackish patches in varying extension, matt; sometimes (in smaller individuals) the whole dorsal side blackish.

Head (Figs. 2a, 13) with coarse, dense punctation, and distinct clypeal suture. Proportions of antennal segments as in Fig. 17, third antennomere long. Male frons with a long left horn pointing more upwards than forwards and bearing an apical hair-brush; left horn frequently wider in the basal part and showing a step before narrowing to the tip (indistinct in specimens with reduced smaller left horn); sometimes left horn reduced to a small tubercle, but



Figs. 1.–8. *Platydema* and *Spiloscapha* spp., ♂♂ in dorsal view, heads magnified. – **1**, **1a**. *Platydema latemarginatum* ♂ non-type (ZSM). **2**, **2a**. *P. omissum* n. sp. ♂ holotype (CRG). **3**, **3a**. *P. castaneoides* n. sp. ♂ holotype (CRG). **4**, **4a**. *P. castaneum* n. sp. ♂ holotype (CRG). **5**. *P. thijlberti* n. sp. ♂ holotype (CRG). **6**. *P. santubongicum* n. sp. ♂ holotype (CRG). **7**. *Spiloscapha medvedevi* n. sp. ♂ holotype (CRG). **8**. *S. bakeri* n. sp. ♂ holotype (BMNH). – Scales: 1 mm (heads), 2 mm (dorsal view of beetles).



Figs. 9–14. *Platydema* spp., ♂♂, heads. – **9**. *P. santubongicum* n. sp. **10**. *P. thijlberti* n. sp. **11**. *P. castaneum* n. sp. **12**. *P. castaneoides* n. sp. **13**. *P. omissum* n. sp. **14**. *P. sericeum*. – Scale: 1 mm.

always bearing a hair-brush; right horn only tubercle-like or even more reduced; clypeus with a distinct anteromedial tooth.

Pronotum slightly convex, with very fine dust-like setation; punctation finer than on head, laterally denser than medially and sometimes confluent; interspaces of punctures shagreened; anterior and lateral margins completely bordered, basal margin unbordered; anterior margin slightly excavate; anterior corners broadly rounded, not protruding. Propleura with fine setigerous punctures.

Elytra slightly convex, 1.2–1.3 times as long as wide, between scutellar row and lateral margin with 8 rows of punctures, third row with about 45 punctures, distance between punctures 0.5–2 times diameter of a puncture, intervals flat with vague punctation; setation as on pronotum.

Abdominal ventrites medially with fine sparse setigerous punctures and longitudinal wrinkles, interspaces between punctures distinctly micro-reticulate.

Legs without modifications, male tarsi not dilated, tibiae externally with indistinct crenulate keels.

Aedeagus see Figs. 22, 23.

Differential diagnosis

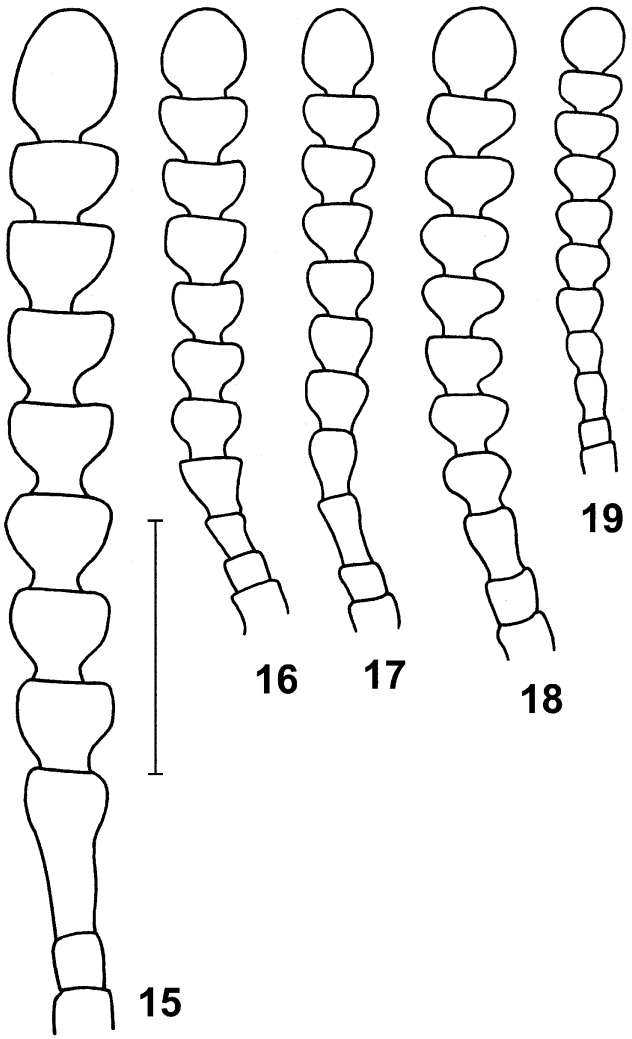
Platydema omissum n. sp. belongs to the group with sericeous dorsal side and very fine dust-like setation, and is quite similar in general shape to *P. latemarginatum* Gebien, but it differs in the shape of the male horns and the aedeagus. The horns of *P. latemarginatum* are regularly narrowing towards the tip, and both have an apical hair-brush (Fig. 1a); the longer left horn of *P. omissum* n. sp. is frequently broader in the basal part and shows a step before it is narrowing towards the tip, and only the left horn has an apical hair-brush (Figs. 2a, 13). The apicale of the aedeagus of *P. latemarginatum* is distinctly sinuate before the tip (Fig. 20), whereas the apicale of *P. omissum* n. sp. is regularly narrowing (Fig. 23) or basally subparallel-sided (Fig. 22). Additionally, *P. latemarginatum* is distinguished from *P. omissum* by the deep pit of the vertex (Fig. 1a).

Distribution

W Malaysia, Vietnam, Sumatra, Mentawei, Nias, Lombok, E Malaysia (Sabah, Sarawak).

Remark

The dorsal colour pattern and other external characters of females of *P. omissum* n. sp. are virtually the same as those of females of *P. latemarginatum*. Thus, females were only included in the type series if they were collected together with males.



Figs. 15–19. *Platydema* spp., antennae. – **15**. *P. castaneum* n. sp. **16**. *P. castaneoides* n. sp. **17**. *P. omissum* n. sp. **18**. *P. santubongicum* n. sp. **19**. *P. thijlberti* n. sp. – Scale: 0.5 mm.

Platydema castaneum **n. sp.**
(Figs. 4, 4a, 11, 15, 24)

Holotype: ♂, Borneo, Malaysia, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 10–200 m, 23.–27.III.2009, R. GRIMM leg. (CRG).

Paratypes: Same data as holotype, 11 ♂♂, 11 ♀♀ (CRG), 2 ♂♂, 2 ♀♀ (SMNS), 1 ♂, 1 ♀ (HNHM), 1 ♂, 2 ♀♀ (ZSM), 1 ♂, 1 ♀ (NHMB-F). – Same data as holotype, but 4.–8.IV.2009, 8 ♂♂, 7 ♀♀; 27.–28.IX.2008, 3 ♀♀; 11.–14.IX.2008, 3 ♂♂, 3 ♀♀ (all CRG).

Etymology

Castaneus (Lat.) = chestnut brown. The species name refers to the castaneous colouration of the species.

Description

Oval, body length 4.8–6.3 mm, body width 3.0–3.7 mm. Dorsal side unicoloured castaneous, shining; tarsi and basal three antennomeres sometimes lighter, apical antennomeres black.

Head with fine sparse punctation. Proportions of antennal segments as in Fig. 15, third antennomere long. Male frons with a longer right and a shorter left horn pointing forwards, sometimes right horn very small and left horn only tubercle-like or completely reduced; clypeus anteromedially without any armature. Interocular space concave in males and females.

Pronotum slightly convex, with fine punctation as on head, between punctures with micro-reticulation becoming stronger laterally; anterior and lateral margins completely bordered, basal margin unbordered; anterior margin slightly excavate with middle part slightly bisinuate; anterior corners broadly rounded, not protruding. Propleura rugulose, intermingled with setigerous punctures.

Elytra slightly convex, 1.1–1.2 times as long as wide, between scutellar row and lateral margin with 8 rows of punctures, third row with about 60 punctures, distance between punctures 0.5–1.5 times diameter of a puncture, intervals flat with very fine and sparse punctation.

Abdominal ventrites medially with fine sparse punctures with short setae, laterally with distinct longitudinal wrinkles, interspaces between punctures distinctly microreticulate.

Legs without modifications, male tarsi not dilated, tibiae externally with indistinct crenulate keels.

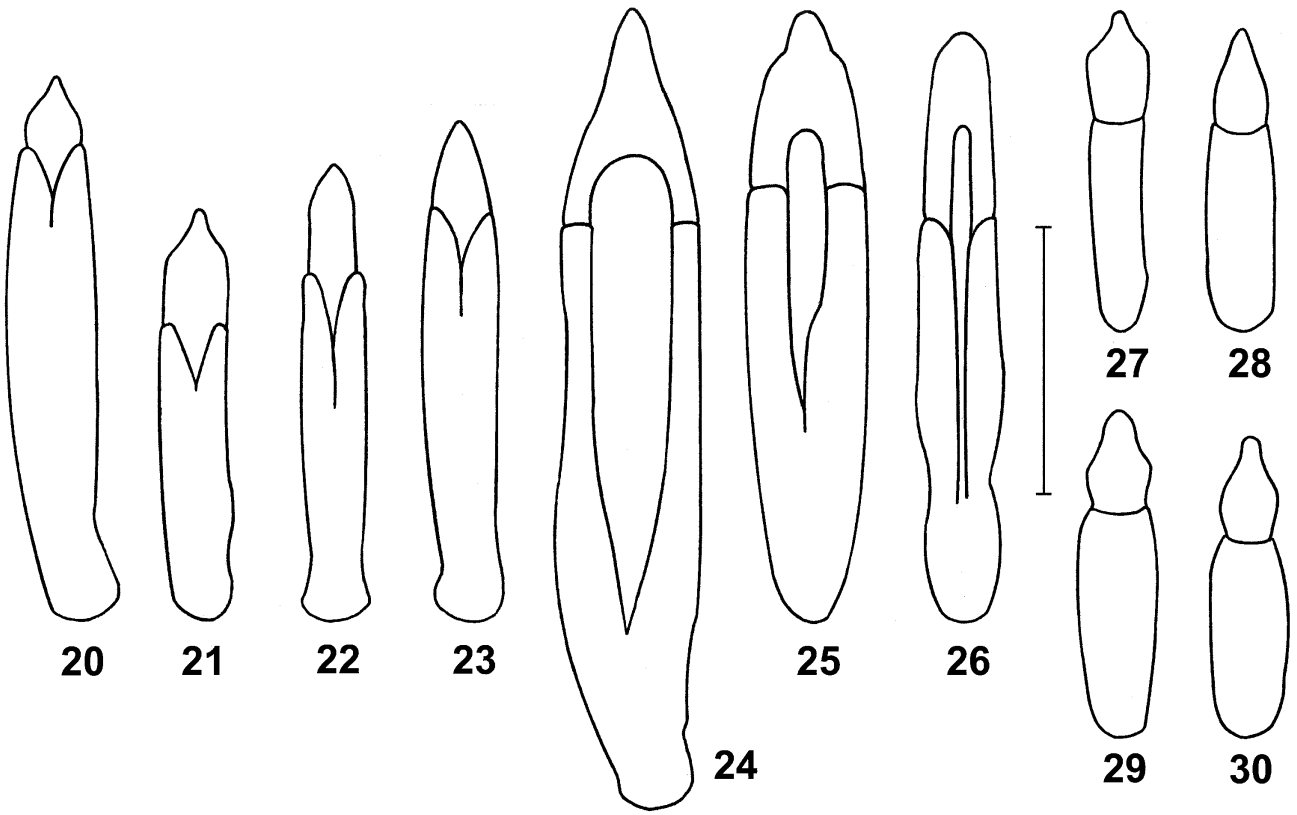
Aedeagus see Fig. 24.

Differential diagnosis

Platydema castaneum n. sp. shares with *P. kovaci* Schawaller, 2004 and *P. riedeli* Schawaller, 2004 the armature of the male head with the long right horn pointing forwards and the left horn tubercle-like. *P. kovaci* (cf. SCHAWALLER 2004: fig. 111) has the aedeagus somewhat similar to that of *P. castaneum* n. sp. (Fig. 24), but can be easily separated by the different colour pattern: *P. kovaci* has a dark pronotum and the elytra are light brown, whereas *P. castaneum* has a unicoloured castaneous dorsal side. *P. riedeli* has the general colouration lighter brown, the elytra with a common dark spot in the anterior part, and the shape of the aedeagus entirely different (cf. SCHAWALLER 2004: fig. 156).

Distribution

E Malaysia, only known from the type locality.



Figs. 20–30. *Platydema* and *Spiloscapha* spp., aedeagi in dorsal view. – **20**. *Platydema latemarginatum*. **21**. *P. sericeum*. **22**, **23**. *P. omissum* n. sp. **24**. *P. castaneum* n. sp. **25**. *P. castaneoides* n. sp. **26**. *P. santubongicum* n. sp. **27**. *P. thijlberti* n. sp. **28**. *Spiloscapha eiliesa*. **29**. *S. medvedevi* n. sp. **30**. *S. bakeri* n. sp. – Scale: 0.5 mm.

Platydema castaneoides **n. sp.**
(Figs. 3, 3a, 12, 16, 25)

Holotype: ♂, Borneo, Malaysia, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 10–200 m, 4.–8.III.2009, R. GRIMM leg. (CRG).

Paratypes: Same data as holotype, 1 ♂, 2 ♀♀ (CRG). – Same data as holotype, but 23.–27.III.2009, 1 ♂, 1 ♀ (CRG), 1 ♀ (SMNS). – Same data as holotype, but 11.–14.IX.2008, at light, 1 ♀ (CRG).

Etymology

Castaneoides = castaneum-like. *P. castaneoides* n. sp. is quite similar to *P. castaneum* n. sp. thus both can be confused on the first sight.

Description

Short oval, body length 3.8–4.6 mm, body width 2.25–3.00 mm. Dorsal side unicoloured castaneous, shining; head, sides of pronotum, legs and basal three antennomeres sometimes lighter, apical antennomeres black.

Head with fine sparse punctation. Proportions of antennal segments as in Fig. 16, third antennomere short. Male frons with a longer right horn pointing forwards, left horn reduced and sometimes only tubercle-like; clypeus without anteromedial armature.

Pronotum slightly convex, with fine punctation as on head, between punctures distinctly micro-reticulate; anterior and lateral margins completely bordered, basal margin unbordered; anterior margin slightly excavate with middle part straight; anterior corners broadly rounded, not protruding. Propleura finely coriaceous.

Elytra distinctly convex, about 1.1–1.2 times as long as wide, between scutellar row and lateral margin with 8 rows of punctures, third row with about 40 punctures, distance between punctures equal to half diameter of a puncture, intervals flat with very fine and sparse punctation.

Abdominal ventrites medially with fine sparse setigerous punctures, laterally with distinct longitudinal wrinkles, interspaces between punctures feebly micro-reticulate.

Legs without modifications, male tarsi not dilated, tibiae externally with indistinct crenulate keels.

Aedeagus see Fig. 25.

Differential diagnosis

Platydema castaneoides n. sp. shares with *P. castaneum* n. sp. the colour pattern and the armature of the male head, but differs in the smaller body size, the rounder and more convex body shape, the distinctly shorter third antennomere (compare Figs. 15, 16), and the shape of the aedeagus (compare Figs. 24, 25). The propleura of *P. castaneoides* n. sp. are very finely coriaceous, those of *P. castaneum* n. sp. are longitudinally wrinkled, intermingled with setigerous punctures. In *P. castaneoides* n. sp. the third elytral row has about 40 punctures, in *P. castaneum* about 60 punctures.

P. castaneoides has a somewhat similar aedeagus as *P. riedeli* (cf. SCHAWALLER 2004: fig. 156) and coincides with the latter in the armature of the head, but *P. castaneoides* n. sp. has a different colour pattern and is distinctly more convex. *P. castaneoides* n. sp. is unicoloured castaneous, whereas in *P. riedeli* the general colour is lighter brown and the elytra have a joint dark spot in the anterior part.

The armature of the head is also similar to that of *P. kovaci*, but *P. castaneoides* n. sp. and *P. kovaci* can be separated by the different shape of the aedeagus (compare Fig. 25, and SCHAWALLER 2004: fig. 111) and the different colour pattern (*P. kovaci* has a dark pronotum and the elytra are light brown).

Distribution

E Malaysia, only known from the type locality.

Platydema santubongicum **n. sp.**
(Figs. 6, 9, 18, 26)

Holotype: ♂, Borneo, Malaysia, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 10–200 m, 23.–27.III.2009, R. GRIMM leg. (CRG); left hind tarsus absent.

Paratypes: Same data as holotype, 3 ♂♂, 3 ♀♀ (CRG), 1 ♂, 1 ♀ (SMNS). – Same data as holotype, but 11.–14.IX.2008, 1 ♀; 4.–8.IV.2009, 1 ♂, 1 ♀ (all CRG).

Etymology

Named after Gunung (= Mount) Santubong where the type series was collected.

Description

Oval, body length 3.75–5.20 mm, body width 2.10–2.75 mm. Dorsal side unicoloured piceous with bluish metallic tinge, shining; palpi, antennae, and legs testaceous to fuscous.

Head with regular and dense punctation. Proportions of antennal segments as in Fig. 18, third antennomere long. Male frons with two symmetrical horns pointing forwards and slightly curved upwards; Figs. 6 and 9 depict a male with long horns; the horns can be reduced so that they do not protrude over the anterior border of the head; clypeus without anteromedial armature. Head in larger females (4.75–5.20 mm) with tubercle-like horns, in smaller females (4.3–4.5 mm) without horns.

Pronotum slightly convex, with punctation as on head; anterior and lateral margins completely bordered, middle of basal margin unbordered; anterior margin slightly excavate with middle part straight; anterior corners broadly rounded, not protruding. Propleura proximally with coarse setigerous punctures, distally with transversal longitudinal wrinkels.

Elytra convex, 1.2–1.3 times as long as wide, between ill-defined scutellar row and lateral margin with 8 rows of punctures in shallow striae, third row with about 45 punctures, intervals feebly convex on disc, more distinct laterally and caudally; punctation on intervals as on pronotum, between punctures distinctly micro-reticulate.

Abdominal ventrites with coarse and dense punctation and short setation, interspaces between punctures micro-reticulate.

Legs without modifications, male tarsi not dilated, tibiae externally with indistinct crenulate keels.

Aedeagus see Fig. 26.

Differential diagnosis

P. santubongicum n. sp. shares with *P. marseuli* Lewis, 1894 and *P. mindanaoicum* Schawaller, 2004 the unicoloured metallic dorsal surface and the pair of symmetrical long horns on the male head. However, it can be distinguished from *P. marseuli* by flat elytral intervals and elytral rows without striae, from *P. mindanaoicum* by the bluish tinge, and from both species by a completely different aedeagus (compare Fig. 26, SCHAWALLER 2004: figs. 108, 117).

Distribution

E Malaysia, only known from the type locality.

Platydema thijlberti **n. sp.**
(Figs. 5, 10, 19, 27)

Holotype: ♂, Borneo, Malaysia, Sarawak, Gunung Gading National Park, 100–300 m, 31.III.–4.IV.2009, R. GRIMM leg. (CRG); left antenna absent, right antenna and left middle tarsus partially absent.

Paratypes: Same data as holotype, 2 ♀♀ (CRG).

Etymology

Named in honour of my colleague and friend THIJLBERT STRUBELT (Neuenbürg-Rotenbach, Germany), for fruitful cooperation in professional matters.

Description

Oval, body length 3.1–3.2 mm, body width 1.50–1.65 mm. Dorsal side unicoloured brownish black, shining; antennae and legs testaceous.

Head with coarse, dense, but not confluent punctation. Proportions of antennal segments as in Fig. 19, third antennomere long. Male frons with two asymmetrical horns, right horn longer and pointing more upwards, left horn shorter and pointing forwards, tip of right horn with sparse setation; clypeus with anteromedial tubercle. Interocular space of females distinctly impressed in the middle.

Pronotum slightly convex, with coarse and regular punctation; anterior and lateral margins completely bordered, basal margin unbordered; anterior margin slightly excavate; anterior and posterior corners broadly rounded. Propleura with sparse setigerous punctures, between punctures finely coriaceous.

Elytra convex, about 1.4 times as long as wide, between scutellar row and lateral margin with 8 rows of punctures in feeble striae, third row with about 50 punctures, distance between punctures less than diameter of a puncture, intervals feebly convex with setigerous punctation distinctly finer and sparser than on pronotum.

Abdominal ventrites with coarse setigerous punctures, interspaces between punctures micro-reticulate, laterally to some extent with longitudinal wrinkles.

Legs without modifications, male tarsi not dilated, tibiae externally with indistinct crenulate keels.

Aedeagus see Fig. 27.

Differential diagnosis

P. thijlberti n. sp., *P. masumotoi* Schawaller, 2004, and *P. subfascium* Walker, 1858 have the same armature of the male head, i. e. two asymmetrical horns, the tip of the longer right horn with setation, and the clypeus with an additional tooth. *P. thijlberti* n. sp. can be separated from both species by smaller body size, completely different colour pattern of the elytra (cf. SCHAWALLER 2003: pl. 4, fig. 4; SCHAWALLER 2004: fig. 32), and different aedeagus (cf. SCHAWALLER 2003: fig. 18; SCHAWALLER 2004: fig. 114).

Distribution

E Malaysia, only known from the type locality.

Platydema javanum Kaszab, 1939

Material studied

Borneo, Malaysia, Sabah, Apin Apin, 350–380 m, H. J. BREMER & R. GRIMM leg., 6.II.2006, 1 specimen (CRG). – Borneo, Malaysia, Sarawak, Santubong Peninsula, Gunung Santubong, 6.IV.2009, R. GRIMM leg., 7 specimens (CRG). – Borneo, Malaysia, Sarawak, Gunung Gading National Park, 100–300 m, 31.–4.IV.2009, R. GRIMM leg., 3 specimens (CRG). – Borneo, Malaysia, Sarawak, Kubah National Park near Headquarter, 27.–28.III.2009, R. GRIMM leg., 5 specimens (CRG). – Borneo, Malaysia, Sarawak, Kubah National Park near Matang Wildlife Centre, 50–100 m, 16.–17.III.2008, R. GRIMM leg., 7 specimens (CRG).

Distribution

W Malaysia, Sumatra, Java (SCHAWALLER 2004), Borneo (new record), Thailand, Sulawesi (new records, based on specimens in CRG).

Platydema nuciferae Blair, 1928

Material studied

Borneo, Malaysia, Sabah, Keningau, 17.–19.II.2006, R. GRIMM leg., 1 specimen (CRG). – Borneo, Malaysia, Sabah, Keningau, 17.II.2006, H. J. BREMER leg., 1 specimen (CRG).

Distribution

Thailand, Vietnam, W Malaysia, Riouw Archipelago, Solomon Islands (SCHAWALLER 2004), Borneo (new record).

Platydema pentaphylloides Kaszab, 1980

Material studied

Borneo, Malaysia, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 10–200 m, 23.–27.III.2008, R. GRIMM leg., 1 specimen (CRG). – Borneo, Malaysia, Sarawak, Santubong Peninsula, Gunung Santubong, 6.IV.2009, R. GRIMM leg., 1 specimen (CRG).

Distribution

Thailand, Vietnam, Sumatra (SCHAWALLER 2004), Borneo (new record).

Platydema unicornis Gebien, 1927

Material studied

Borneo, Malaysia, Sabah, Apin Apin, 350–380 m, 6.II.2006, H. J. BREMER & R. GRIMM leg., 1 ♂ (CRG).

Distribution

Thailand, W Malaysia, Sumatra (SCHAWALLER 2004), Borneo (new record).

Spiloscapha medvedevi **n. sp.**

(Figs. 7, 29)

Holotype: ♂, Borneo, Malaysia, Sarawak, Gunung Gading National Park, 100–300 m, 23.–29.IX.2008, R. GRIMM leg. (CRG).

Paratypes: Same data as holotype, 16 specimens (CRG), 5 specimens (SMNS). – Same data as holotype, but 31.III.–4.IV.2009, 42 specimens (CRG), 5 specimens (BMNH), 5 specimens (HNHM), 5 specimens (NHMB-F), 3 specimens (SDEI), 5 specimens (SMNS), 5 specimens (ZSM), 5 specimens (CKA).

Etymology

Named in honour of the late colleague Prof. GLEB S. MEDVEDEV (St. Petersburg, † 23.IX.2009), contributor of numerous and substantial papers on tenebrionid taxonomy.

Description

Oblong-oval, body length 3.1–3.7 mm, body width 1.5–1.9 mm, shining. Dorsal and ventral side castaneous (in mature specimens), parts of pronotum and elytra irregularly blackish, elytra often with an irregular transverse patch near the middle and an irregular patch near the apex. Scape, pedicel and third antennomere castaneous, flagellum from tip of third to last antennomere black, distal part of last antennomere ferrugineous.

Head with punctation denser and somewhat coarser than on pronotum, distance between punctures 2 times diameter of a puncture. Clypeus truncate at apex, fronto-clypeal suture distinct, with lateral depression behind fronto-clypeal suture. Genae long and oblique, moderately convex. Eyes without inner ocular sulcus, strongly divided by genal canthus.

Pronotum trapezoidal, with punctation sparser and somewhat finer than on head, distance between punctures about 1–4 times diameter of a puncture, punctures setigerous in part; anterior margin slightly emarginated, roundly and slightly produced in the median third, bordered in the lateral third; lateral margins weakly curved and slightly narrowing forwards, broadly sulcate with setigerous punctures; basal margin slightly sinuate and unbordered; anterior angles obtuse, hardly produced, posterior angles rectangular. Propleura with sparse, fine punctures.

Elytra moderately convex, between ill-defined scutellar row and lateral margin with 8 rows of punctures, eighth row obsolete, third row with about 45 punctures, distance between punctures 1–2 times diameter of a puncture, intervals flat, with minute sparse punctures; first, third, fifth and seventh intervals with rows of setigerous punctures, about 20 punctures in the first interval; size of punctures as in primary rows, distance between punctures about 5–10 times diameter of a puncture; lateral margin in dorsal view visible almost over its entire length, not discernible only before apex.

Punctures on metasternum and abdominal ventrites somewhat coarser laterally than medially.

Aedeagus see Fig. 29.

Differential diagnosis

Spiloscapha medvedevi n. sp. is similar to *S. eiliesa* Schawaller, 1997. However, in *S. eiliesa* the dorsal side is ferrugineous without colour pattern (castaneous with parts of pronotum and elytra irregularly blackish in mature specimens of *S. medvedevi* n. sp.), the rows of setigerous punctures of the alternate elytral intervals are more irregular and with larger punctures than those of the primary rows (punctures of primary rows and alternate rows of intervals equal in size in *P. medvedevi* n. sp.), and the shape of the aedeagus is different (compare Figs. 28, 29).

Distribution

E Malaysia, only known from the type locality.

Spiloscapha bakeri **n. sp.**
(Figs. 8, 30)

Holotype: ♂, Brit. N. Borneo, Sandakan, 1919-2, C. F. BAKER leg. (BMNH).

Etymology

Named after CHARLES FULLER BAKER (1872–1927), collector of the holotype.

Description

Oblong-oval, body length 3 mm, body width 1.6 mm, shining. Dorsal and ventral side of body including legs and palpi fuscous; elytra with slightly lighter humeral spot; antennae blackish-brown, with the three basal antennomeres and the last one fulvous.

Head coarsely punctate, punctation denser on clypeus and frons than on vertex. Clypeus truncate at apex, fronto-clypeal suture obsolete, with lateral depression behind fronto-clypeal suture. Genae long and oblique, moderately convex. Eyes without inner ocular sulcus, strongly divided by genal canthus.

Pronotum trapezoidal, with punctation as on head, distance between punctures about 0.5–5 times diameter of a puncture, punctures setigerous in part; anterior margin slightly emarginate, bordered in the lateral third; lateral margins weakly curved and slightly narrowing forwards, broadly sulcate with setigerous punctures; basal margin very slightly sinuate and unbordered; anterior angles obtuse, hardly produced, posterior angles rectangular. Propleura smooth with only inner anterior part coarsely punctured.

Elytra moderately convex, between ill-defined scutellar row and lateral margin with 8 rows of punctures, eighth row obsolete, third row with about 35 punctures, distance between punctures 0.5–1.5 times diameter of a puncture, intervals flat; first, third, fifth and seventh intervals with rows of setigerous punctures, about 10 punctures in the first interval; punctures smaller as in primary rows, and hardly perceptible if setae are rubbed off; lateral margin in dorsal view visible almost over its entire length, not discernible only before apex.

Punctures on metasternum and abdominal ventrites 1–4 somewhat coarser laterally than medially. Last ventrite finer and less densely punctured.

Aedeagus see Fig. 30.

Differential diagnosis

Spiloscapha bakeri n. sp. shares with *S. unicolor*, Blair, 1937 from India and Thailand the nearly unicoloured dorsal side with only an indistinct humeral spot, and a somewhat similar aedeagus (compare Fig. 30 and SCHAWALLER 1997: fig. 30). *S. bakeri* n. sp. can be distinguished from *S. unicolor* by fulvous colouration (ferrugineous in *S. unicolor*), less dense and less coarse punctation of the head, lighter (fuscous) last antennomere, flat elytral intervals and puncture rows without striae (somewhat convex and rows in striae in *S. unicolor*), and about 35 punctures in the third row (about 45 in *S. unicolor*).

Distribution

E Malaysia, only known from the type locality.

Leiochrinini Lewis, 1894

Derispia batuica Schawaller, 2005

Material studied

Borneo, Malaysia, Sarawak, Gunung Gading National Park, 100–250 m, 9.–12.III.2008, R. GRIMM leg., 6 specimens (CRG). – Borneo, Malaysia, Sarawak, Santubong Peninsula, Permai Rainforest Resort, 20–160 m, 13.–15.III.2008, R. GRIMM leg., 1 specimen (CRG).

Distribution

W Malaysia (SCHAWALLER 2005a), Borneo (new record).

Derispia titschacki Kaszab, 1946

Material studied

Borneo, Malaysia, Sarawak, Kuching, Reservoir Park, 50 m, 4.–5.III.2008, R. GRIMM leg., 8 specimens (CRG); 9.–10.IX.2008, 1 specimen (CRG).

Distribution

Southern China, W Malaysia (SCHAWALLER 2005a), Borneo (new record).

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The genus *Corticeus* Piller & Mitterpacher (Coleoptera: Tenebrionidae) in arboreal habitats of South Africa[1]

Wolfgang Schawaller

Abstract

The species of the genus *Corticeus* Piller & Mitterpacher, 1783 (Tenebrionidae: Diaperinae: Hypophlaeini) from South Africa are compiled. Newly collected specimens are listed, additional records originate from adjacent Namibia, Botswana, Zimbabwe and Mozambique. To facilitate subsequent identifications photographs of all 18 species from this area are included. All species of the genus *Corticeus* have an arboreal mode of life and live together with their larvae, often in aggregations, under the bark of trees. They are more abundant in the eastern and northern parts of South Africa, but are lacking in the drier tree-less western parts.

Keywords: Coleoptera, Tenebrionidae, *Corticeus*, South Africa, new records.

Zusammenfassung

Die Arten der Gattung *Corticeus* Piller & Mitterpacher, 1783 (Tenebrionidae: Diaperinae: Hypophlaeini) aus Südafrika werden zusammengestellt. Neu gesammelte Exemplare werden aufgelistet, zusätzliche Nachweise stammen aus dem angrenzenden Namibia, Botswana, Zimbabwe und Mozambique. Um spätere Bestimmungen zu erleichtern, werden Fotografien aller 18 Arten beigefügt. Alle Arten der Gattung *Corticeus* haben eine arboreale Lebensweise und leben zusammen mit ihren Larven, oft vergesellschaftet, unter Baumrinden. Sie sind häufiger in den östlichen und nördlichen Regionen Südafrikas, fehlen aber in den trockeneren, baumlosen westlichen Teilen.

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1 Introduction

The species of the genus *Corticeus* Piller & Mitterpacher, 1783 (Tenebrionidae: Diaperinae: Hypophlaeini) from Africa south of the Sahara including Madagascar were revised by Bremer (1985, 1987, 1995). Since that time, newly collected specimens have been accumulated in different collections. The present paper gives the current state of knowledge about the genus in South Africa, based on literature and own research. Additional records from adjacent Namibia, Botswana, Zimbabwe and Mozambique are treated as well. Photographs to facilitate subsequent identifications of all 18 species are included.

Acronyms of depositories

CRSW	Collection Rudolf Schuh, Wien
HNHM	Hungarian Natural History Museum, Budapest
MNB	Museum für Naturkunde, Berlin
SMNS	Staatliches Museum für Naturkunde, Stuttgart
TMSA	Transvaal Museum, Pretoria
ZSM	Zoologische Staatssammlung, München

Acknowledgements

South African authorities kindly provided permits for joint field work in cooperation with Ruth Müller (Transvaal Museum Pretoria). Dr. Ottó Merkl (Budapest), Ruth Müller (Pretoria), as well as Bernd Jaeger and Dr. Manfred Uhlig (both Berlin) supported my studies by the loan of specimens from the collections under their care. My colleague Johannes Reibnitz (Stuttgart) prepared the photographs using a Leica DFC 480 digital camera on a Leica MZ16 APO microscope. The digital photographs were subsequently processed using Leica LAS software. Last but not least I thank Prof. Dr. Hans J. Bremer (Melle) for helpful comments on certain species and types. Thanks are also due to the referees Dr. Kiyoshi Ando (Osaka) and Prof. Dr. Kimio Masumoto (Tokyo) for their comments and corrections.

2 The species

Corticeus cedrinus Bremer, 1995
(Fig. 17)

New material: South Africa, N Drakensberge, 17.XII.1996, leg. P. Macháček, 1 ex. SMNS (det. Bremer).

[1] Contributions to Tenebrionidae, no. 82. – For no. 81 see: Caucasian entomological Bulletin 5 (2009).

– South Africa, Mpumalanga, Sjonajona, Badplaas, 1410 m, 11.XI.2002, leg. TMSA staff, 1 ex. TMSA.

Type locality: South Africa, "Cederberge".

Distribution: South Africa (Western Cape) (Bremer 1995); South Africa (KwaZulu-Natal, Mpumalanga) (new records).

Corticeus chakai Bremer, 1995
(Fig. 12)

New material: South Africa, Eastern Cape, Mbotyi Coastal Forest, 29.XI.–3.XII.2003, leg. M. Burger, R. Müller & W. Schawaller, 2 ex. TMSA, 1 ex. SMNS. – South Africa, Eastern Cape, Port St. Johns, Silaka Nature Reserve, 7.–8.I.2009, leg. P. Schüle, 1 ex. SMNS. – South Africa, Eastern Cape, Double Drift Nature Reserve, 11.–12.I.2009, leg. P. Schüle, 1 ex. SMNS. – South Africa, Mpumalanga, Mariepskop Forest Reserve, gallery forest of Blyde River, 800–1000 m, 23.–26.XI.2008, leg. W. Schawaller, 1 ex. SMNS.

Type locality: South Africa, "East London".

Distribution: South Africa (Eastern Cape, Natal, Mpumalanga) (Bremer 1995).

Corticeus egregius Bremer, 1995
(Fig. 1)

New material: South Africa, KwaZulu-Natal, 15 km S Eshowe, Entumeni Forest, 6.–7.XII.2000, leg. S. Bečvář, 1 ex. SMNS.

Type locality: South Africa, "Pondoland", "Port St. Johns".

Distribution: Mozambique, Zimbabwe, South Africa (Eastern Cape) (Bremer 1995); South Africa (KwaZulu-Natal) (new record).

Corticeus glabratus (Kolbe, 1898)
(Fig. 2)

New material: W Kenya, Kagamega Forest Nature Reserve, 1600 m, 21.IX.–10.X.2005, leg. J. Holstein & D. Bartsch, 1 ex. SMNS. – Swaziland, Mliliwane Wildlife Sanctuary near Mbabane, 21.–22.XI.2001, leg. P. Schüle, 1 ex. SMNS. – S Uganda, road Mbarara to Kasese, Kalinzu Forest, 1400 m, 4.IV.2007, leg. A. Puchner, 1 ex. CRSW. – NW Botswana, Tsodili Hills, 1000 m, 18.–19.III.2006, leg. W. Schawaller, 1 ex. SMNS. – South Africa, KwaZulu-Natal, Tembe Elefant Park, 17.–19.XI.2002, leg. W. Schawaller, 1 ex. SMNS. – South Africa, KwaZulu-Natal, Kosi Bay Nature Reserve, 11.–17.XI.2002, leg. W. Schawaller, 5 ex. SMNS. – South Africa, Eastern Cape, Port St. Johns, Silaka Nature Reserve, 7.–8.I.2009, leg. P. Schüle, 1 ex. SMNS.

Type locality: "Usambara".

Distribution: Cameroon, Zaire, Tanzania, Kenya, Uganda, Malawi, Mozambique, Zambia, South Africa (KwaZulu-Natal, Eastern Cape) (Bremer 1995); Swaziland, Botswana (new records).

Corticeus gracilis Bremer, 1995
(Fig. 13)

New material: South Africa, Northern Province, Combretum Park, NE Nylstroom, 9.XI.2002, leg. W. Schawaller, 9 ex. SMNS. – South Africa, KwaZulu-Natal, Kosi Bay Nature Reserve, 11.–17.XI.2002, leg. J. Harrison, R. Müller & W. Schawaller, 34 ex. TMSA, 11 ex. SMNS. – South Africa, KwaZulu-Natal, Tembe Elefant Park, 17.–19.XI.2002, leg. J. Harrison, R. Müller & W. Schawaller, 1 ex. SMNS, 1 ex. TMSA. – South Africa, KwaZulu-Natal, SW Mugudu, 4.–5.I.2009, leg. P. Schüle, 5 ex. SMNS.

Type locality: South Africa, "Natal", "Weza".

Distribution: South Africa (Natal) (Bremer 1995); South Africa (Northern Province, KwaZulu-Natal) (new records).

Corticeus hiekei Bremer, 1995
(Fig. 11)

New material: NW Botswana, Tsodili Hills, 1000 m, 18.–19.III.2006, leg. W. Schawaller, 1 ex. SMNS. – Namibia, Okawango Distr., Mutompo, 60 km S Rundu, 1180 m, 15.III.2003, leg. J. Frisch & K. Vohland (BIOTA 1557), 1 ex. MNB.

Type locality: "Deutsch-Ost-Afrika", "Muansa".

Distribution: Tanzania (Bremer 1995); Botswana, Namibia (new records); to be expected also in South Africa.

Corticeus kaszabi natalensis Bremer, 1995
(Fig. 5)

New material: South Africa, KwaZulu-Natal, Tembe Elefant Park, 17.–19.XI.2002, leg. W. Schawaller, 1 ex. SMNS.

Type locality: Kenya, "Marakwet" (ssp. *kaszabi*); South Africa, "Natal", "Vernham" (ssp. *natalensis*).

Distribution: South Africa (Zululand, Natal, Transvaal), Zimbabwe (Bremer 1995).

Corticeus longicollis (Wollaston, 1867)
(Fig. 3)

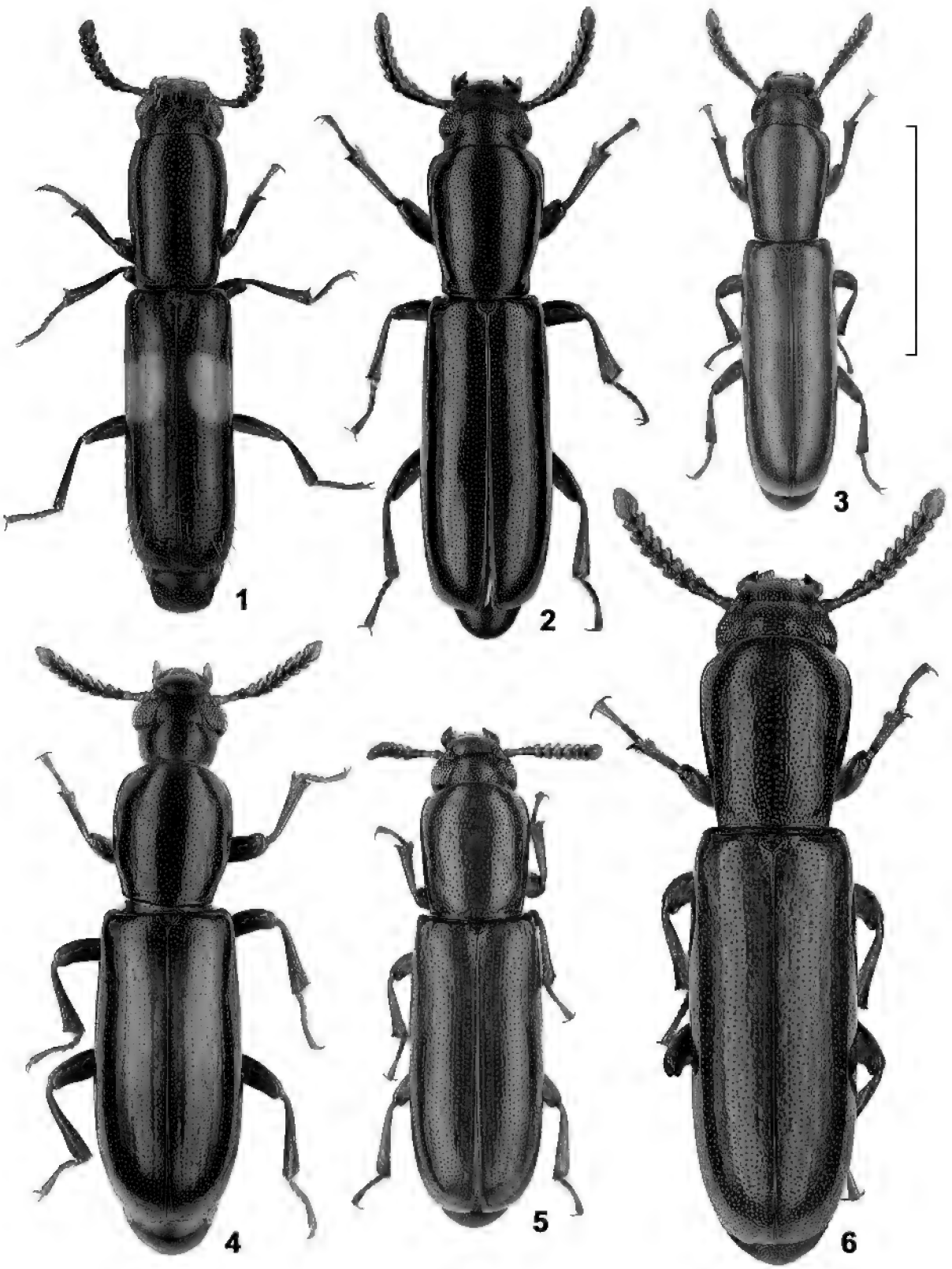
New material: N Namibia, Waterberg Park, 1500 m, 6.–7.III.2006, leg. R. Müller & W. Schawaller, 20 ex. TMSA, 6 ex. SMNS.

Type locality: Cape Verde Islands, "S. Jago Island".

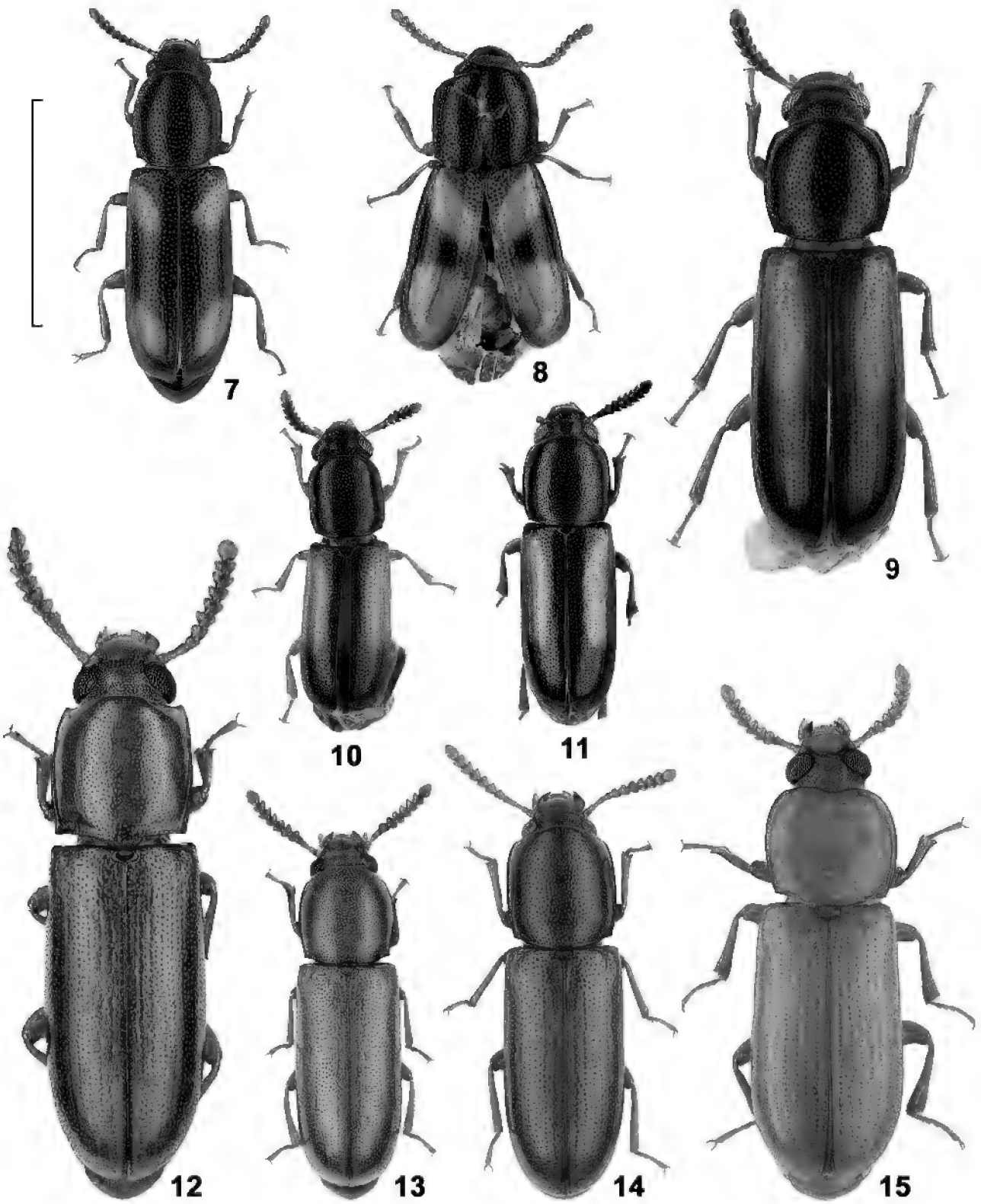
Distribution: Cape Verde Islands, Gambia, West Africa, Zaire, Uganda, Tanzania, Angola (Bremer 1995); Yemen (Schawaller 2007); Namibia (new record); to be expected also in South Africa.

Corticeus mocquerysi (Pic, 1914)
(Fig. 18)

New material: South Africa, KwaZulu-Natal, Ndumu Game Reserve, 20.–22.XI.2002, leg. J. Harrison, R. Müller & W. Schawaller, 3 ex. SMNS, 1 ex. TMSA. – South Africa,



Figs. 1–6. *Corticeus* spp., dorsal view. – **1**. *C. egregius*, paratype TMSA. **2**. *C. glabratus*, non-type SMNS. **3**. *C. longicollis*, non-type SMNS. **4**. *C. voluptuosus*, paratype MNB. **5**. *C. kaszabi natalensis*, paratype SMNS. **6**. *C. volvulus*, non-type SMNS. – Scale: 2 mm.



Figs. 7–15. *Corticeus* spp., dorsal view. – **7**. *C. schereri*, paratype HNHM. **8**. *C. speciosus*, non-type SMNS. **9**. *C. slipinskii*, paratype MNB. **10**. *C. penrithae*, non-type MNB. **11**. *C. hiekei*, holotype MNB. **12**. *C. chakai*, non-type SMNS. **13**. *C. gracilis*, non-type SMNS. **14**. *C. xhosa*, paratype SMNS. **15**. *C. praecipuus*, holotype TMSA. – Scale: 2 mm.

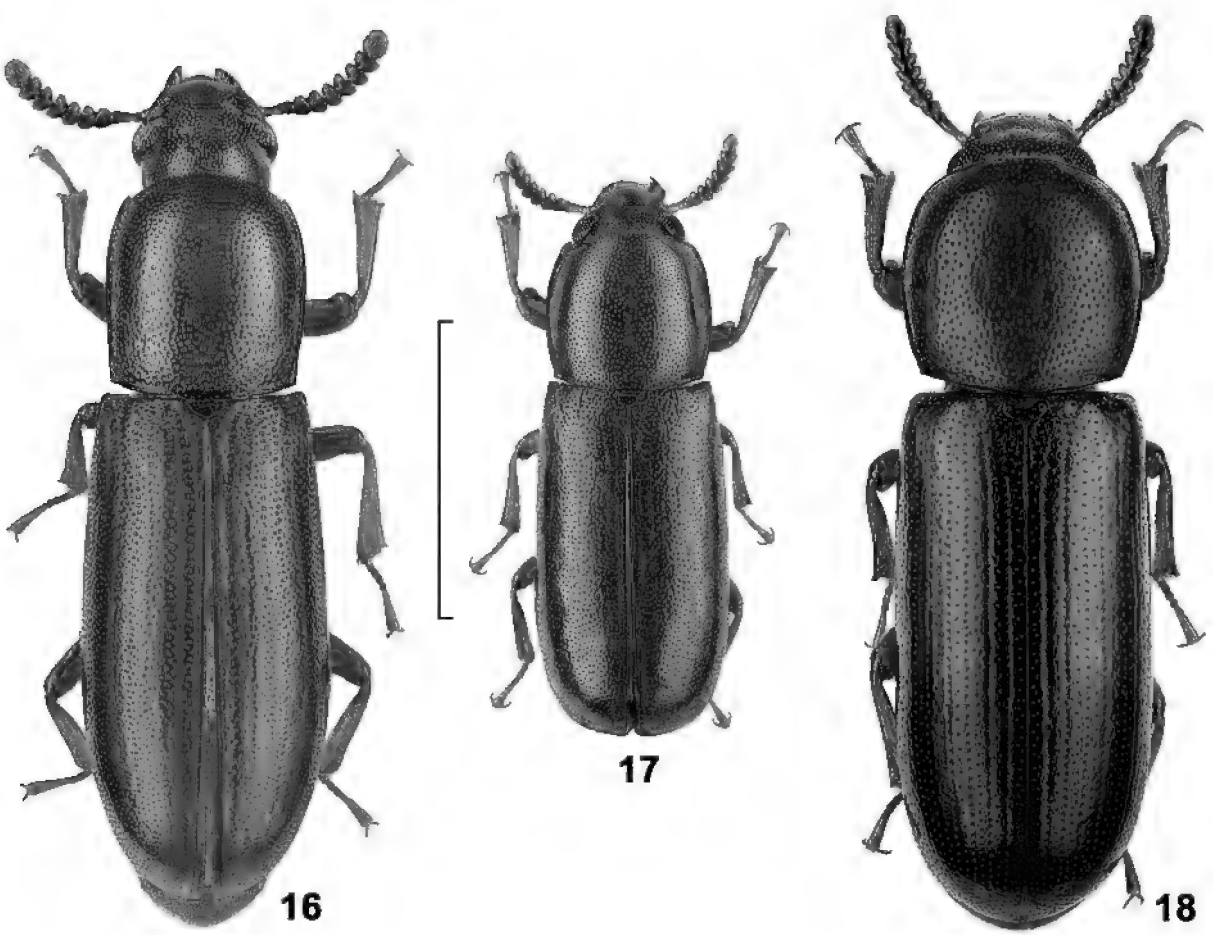
KwaZulu-Natal, SW Mugudu, 4.–5.I.2009, leg. P. SCHÜLE, 4 ex. SMNS. – South Africa, Northern Province, Arbor Farm, Levubu, 28.I.1998, leg. R. MÜLLER, 1 ex. TMSA. – South Africa, Northern Province, 33 km NE Vaalwater, Lindani Nature Reserve, 18.–19.XI.2004, leg. P. SCHÜLE, 1 ex. SMNS. – South Africa, Limpopo, Lindani Nature Reserve, 4.I.2008, leg. R. MÜLLER, 1 ex. TMSA. – South Africa, Limpopo, Lekgalameetse Nature Reserve, 800–1000 m, 27.XI.–1.XII.2008, leg. W. SCHAWALLER, 1 ex. SMNS. – South Africa, Limpopo, 10 km N Modimolle (Nylstroom), Kuthaba Bush Lodge, 1300 m, 10.–13.XII.2008, leg. W. SCHAWALLER, 1 ex. SMNS. – South Africa, Mpumalanga, Helena Farm, 1091 m, 11.II.2002, leg. TMSA staff, 4 ex. TMSA. – South Africa, Mpumalanga, Der Brochen Farm, 11.II.2002 and 7.XII.2005, leg. TMSA staff, 2 ex. TMSA. – South Africa, Mpumalanga, Steelport, 15.X.2002, leg. M. BURGER & J. LEGWAI, 1 ex. TMSA. – South Africa, Mpumalanga, Groblersdal, 19.I.2004 and 10.III.2005, leg. TMSA staff, 2 ex. TMSA. – South Africa, Mpumalanga, Mariepskop Forest Reserve, gallery forest of Blyde River, 800–1000 m, 23.–26.XI.2008, leg. R. MÜLLER, 1 ex. TMSA. – South Africa, Waterberg, Geelhoutbosch Farm, 13.–15.XII.1997, leg. C. BELLAMY, 19 ex. TMSA. – South Africa, Gauteng, Tswaing, 17.II. and 24.XI.2003, leg. TMSA staff, 2 ex. TMSA. – Namibia, Kavango, Mahango Game Reserve, 24.XI.1993, leg. M. UHLIG, 3 ex. MNB (det. BREMER). – Namibia, Otjozondjupa Distr., Otjiamongombe West 44, 1498 m, 28.II.2003, leg. J. FRISCH & K. VOHLAND (BIOTA 1529), 1 ex. MNB. – Zimbabwe, Nyagui Valley, 50 km E Bindura, 16.XII.1996, leg. F. KANTNER, 1 ex. SMNS. – Zimbabwe, Bubi Valley, 70 km N Beitbridge, 8.XII.1998, leg. F. KANTNER, 1 ex. SMNS. – Tanzania, 70 km N Dodoma, 1330 m, 17.XII.2006, leg. F. KANTNER, 1 ex. SMNS.

Type locality: "Gabon".

Distribution: Widely distributed in all subsaharan Africa, South Africa (Transvaal, Transkei) (BREMER 1995); Namibia, South Africa (KwaZulu-Natal, Mpumalanga, Northern Province, Gauteng) (new records).

Corticeus penrithae Bremer, 1995
(Fig. 10)

New material: South Africa, Kruger National Park, Skukuza Research Camp, 3.–6.III.1996, leg. S. ENDRÖDY-YOUNGA, 2 ex. TMSA. – Same data as before, but 1.III.1995, 1 ex. TMSA. – Same data as before, but 13.I.1996, 1 ex. TMSA. – South Africa,



Figs. 16–18. *Corticeus* spp., dorsal view. – **16**. *C. punctipennis*, paralectotype MNB. **17**. *C. cedrinus*, holotype TMSA. **18**. *C. mocquerysi*, non-type SMNS. – Scale: 2 mm.

Natal, Itala Game Reserve, 27.–29.I.1994, leg. M. UHLIG, 1 ex. MNB. – South Africa, KwaZulu-Natal, Kosi Bay Nature Reserve, 11.–17.XI.2002, leg. W. SCHAWALLER, 3 ex. SMNS. – South Africa, KwaZulu-Natal, SW Mugudu, 4.–5.I.2009, leg. P. SCHÜLE, 6 ex. SMNS.

Type locality: South Africa, "Transvaal", "Penge".

Distribution: South Africa (Transvaal) (BREMER 1995); South Africa (Limpopo, KwaZulu-Natal) (new records).

Corticeus praecipuus Bremer, 1995
(Fig. 15)

Type locality: South Africa, "Cape Amatole", "Isidenge".

Distribution: South Africa (Eastern Cape) (BREMER 1995).

Corticeus punctipennis (Gebien, 1910)
(Fig. 16)

New material: Uganda, Jinja, VII.1931, leg. VAN SOMEREN, 1 ex. SMNS (det. BREMER). – South Africa, Eastern Cape, Dwesa Nature Reserve, 10.I.2009, leg. P. SCHÜLE, 5 ex. SMNS.

Type locality: "Kilimandjaro".

Distribution: Tanzania, Uganda, Zaire, South Africa (Natal), Lesotho (BREMER 1995); South Africa (Eastern Cape) (new record).

Corticeus schereri Bremer, 1995
(Fig. 7)

Type locality: South Africa, "Mountain Zebra NP", "Craddock".

Distribution: South Africa (Eastern Cape) (BREMER 1995).

Corticeus slipinskii Bremer, 1995
(Fig. 9)

Type locality: "Congo Belge", "Parc Nacional de Garamba".

Distribution: Congo, Tanzania, Zambia, Malawi (BREMER 1995); to be expected also in South Africa.

Corticeus speciosus Bremer, 1995
(Fig. 8)

New material: South Africa, Eastern Cape Prov., Alexandria Forest Station, 4.XII.1987, leg. S. ENDRÖDY-YOUNGA, 4 ex. TMSA, 1 ex. SMNS.

Type locality: South Africa, "Transkei", "Port St. John".

Distribution: South Africa (Transkei, Natal) (BREMER 1995).

Corticeus voluptuosus Bremer, 1995
(Fig. 4)

Type locality: South Africa, "Cape Amatole", "Isidenge".

Distribution: South Africa (Eastern Cape) (BREMER 1995).

Corticeus volvulus (Gerstaecker, 1871)
(Fig. 6)

New material: Zimbabwe, Manicaland, 20 km SE Mutare, Vumba Mts., Bunga Forest, 1645 m, 28.–29.XI.2006, leg. S. GUSSMANN, R. MÜLLER & P. SCHÜLE, 15 ex. TMSA, 7 ex. SMNS. – Zimbabwe, Chirinda Forest, 2.XII.2004, leg. S. GUSSMANN & R. MÜLLER, 1 ex. TMSA. – Mozambique, Sofala Prov., Mt. Gorongosa, Mountain Forest, 1400–1700 m, 1.–2.XII.2006, leg. P. SCHÜLE, 4 ex. SMNS. – South Africa, Natal Midland, Karkloof Forest, 11.XII.1989, leg. S. ENDRÖDY-YOUNGA, 1 ex. TMSA. – South Africa, Eastern Cape, Mbotyi Coastal Forest, 29.XI.–3.XII.2003, leg. M. BURGER, R. MÜLLER & W. SCHAWALLER, 4 ex. TMSA, 3 ex. SMNS. – South Africa, Eastern Cape, Dwesa Nature Reserve (The Haven), 4.–6.XII.2003, leg. W. SCHAWALLER, 1 ex. SMNS. – South Africa, Zululand [= KwaZulu-Natal], Hluhluwe Game Reserve, 20.XI.1992, leg. S. ENDRÖDY-YOUNGA, 6 ex. TMSA, 1 ex. SMNS.

Type locality: Tanzania, "Ugono-Berge".

Distribution: Tanzania, Kenya, Uganda, Ruanda, Zambia, Zimbabwe, South Africa (KwaZulu-Natal, Eastern Cape) (BREMER 1995); Mozambique (new record).

Corticeus xhosa Bremer, 1995
(Fig. 14)

New material: South Africa, Limpopo Prov., Lajuma, Southpansberg, tree fogging, 10.II.2008, leg. D. DE BAKKER, R. JOCQUÉ et al., 9 ex. SMNS. – South Africa, Natal Midland, Karkloof Forest, 1300 m, 2.XII.1989, leg. S. ENDRÖDY-YOUNGA & J. KLIMASZEWSKI, 3 ex. TMSA. – South Africa, KwaZulu-Natal, Cathedral Peak Park, 1500 m, 24.–27.XI.2003, leg. M. BURGER, R. MÜLLER & W. SCHAWALLER, 2 ex. SMNS, 1 ex. TMSA. – South Africa, KwaZulu-Natal, Kamberg Nature Reserve, 29.XI.2000, leg. P. SCHÜLE, 1 ex. SMNS. – South Africa, Eastern Cape, 50 km W Graaf-Reinet, E Mt. Torberg, 1200–1600 m, 21.–25.XI.2007, leg. R. MÜLLER & W. SCHAWALLER, 10 ex. TMSA, 16 ex. SMNS. – South Africa, Eastern Cape, Fort Fordyce Forest Reserve, 1000 m, 4.XII.2007, leg. R. MÜLLER, 1 ex. TMSA.

Type locality: South Africa, "Natal", "Kloof".

Remarks: Males possess a small finely punctured but not tubercle-like area on the frons, which is present also in the similar species *C. gracilis*. This (feeble) sexually dimorphic character was unknown to BREMER (1995). In other species, like *C. praecipuus*, such a modification on the male frons is more distinct and was previously known.

Distribution: South Africa (Transvaal, Natal, Transkei, Knysna, Cape Amatole) (BREMER 1995).

3 Biology

The species of the genus *Corticeus* have an arboreal mode of life and co-occur with their larvae, often in aggregations, under the bark of trees. It is not yet clear if the beetles, or more likely their larvae, are predaceous on the larvae of bark beetles (Scolytidae), or if they – possibly – frequent their galleries only for feeding on the exuding sap and detritus contained in them. According to own observations, species of *Corticeus* prefer trees in an early stage of decomposition and do not settle older, completely decayed wood. It is unknown whether the species are specialized on certain tree species with a suitable bark structure or whether the stage of the wood decomposition is the decisive factor. In any case it is evident that the abundance of species in South Africa must depend on the distribution of trees and forests. In other words: species of *Corticeus* are more abundant in the eastern and northern parts of the country and are lacking in the drier, tree-less western parts.

4 References

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Check-list of the Tenebrionidae (sensu stricto) from Madagascar (Coleoptera)[1]

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Abstract

A check-list of the Tenebrionidae (sensu stricto) from Madagascar (Coleoptera) is compiled, based on the literature and a few newly added records from the Natural History Museum in Stuttgart. Synanthropic species with worldwide distribution are not included in the present list of 719 species. Distributional patterns of the Malagasy tenebrionids are widely unknown.

K e y w o r d s : Coleoptera, Tenebrionidae, check-list, bibliography, Madagascar.

Zusammenfassung

Eine Checkliste der Tenebrionidae (sensu stricto) von Madagaskar (Coleoptera) wird zusammengestellt, basierend auf der Literatur und einigen neueren Angaben aus dem Naturkundemuseum Stuttgart. Synanthrope Arten mit weltweiter Verbreitung sind in der Auflistung der insgesamt 719 Arten nicht enthalten. Verbreitungsmuster der Tenebrioniden auf Madagaskar sind weitgehend unbekannt.

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1 Introduction

Tenebrionidae are one of the largest Coleoptera families occurring in all terrestrial habitats from the sea shore up to dry desert and steppe habitats in all altitudinal belts, and in all types of forests. So far, no attempt has been made to compile all tenebrionid species from Madagascar. Newly collected material induced me to fill up this gap. The present check-list contains all species and subspecies (but not infraspecific varieties) recorded from Madagascar in the world catalogue of Gebien (1936ff) and in subsequent publications. To avoid repetitions, the list of references does not contain the older references cited by Gebien. Bates (1879) and Chatanay (1915) are nevertheless referred because these two papers especially treat Malagasy Tenebrionidae.

The order of the tribes follows Gebien's (1936ff) catalogue, the remaining taxa are listed alphabetically. In a few cases, I added unpublished records based on specimens from the Natural History Museum in Stuttgart (SMNS).

Tenebrionidae are considered herein in a historical (typological) sense, excluding the subfamily Alleculinae and those tribes of Lagriinae previously classified in the family Lagriidae. A modern classification of the complete family was compiled by Bouchard et al. (2005). Although the present list contains a total of 719 species from Madagascar, it is far from being complete. Several taxonomic problems on the species level as well as on the genus level are still unsolved and several genera must be revised. Many new species are still hidden in the Malagasy forests (better: forest remnants) and await their description. Special collecting methods, particularly sifting and fogging, will surely significantly increase species numbers. It might also be possible that additional synanthropic species with worldwide distribution will be found on Madagascar.

Detailed distributional patterns of the Malagasy tenebrionids are mostly unknown. The members of this family display a high ecological plasticity. Several taxa are adapted to drier habitats while others are restricted to humid forests of all types. Thus, most of the tenebrionid species are surely not distributed over the whole island of Madagascar but show fragmentary distributional patterns. Some arboreal taxa might be considered as indicators for mature forests. Those are extremely threatened by the continuous cutting and burning of all forest types. Many species will probably be extinct before somebody could have discovered and described them.

[1] Contributions to Tenebrionidae, no. 83. – For no. 82 see: Stuttgarter Beiträge zur Naturkunde A, Neue Serie 3 (2010).

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My colleagues Friederike Woog, Kathrin Marquart and Daniel Bartsch (all Stuttgart) and the Malagasy entomologist Randriamanaitra Tahiana conducted ornithological, mammalogical and entomological field work in the Maromizaha Forest close to Andasibe (Perinet) in Madagascar. They were able to collect also some tenebrionids, waiting for identification and being the "kick" for compiling this list. Through the kind help of Mrs. Olga Ravaohangimalala (Université d'Antananarivo) collection and export permits were granted by the Malagasy government (Direction de la Préservation de la Biodiversité). Ruth Müller (Pretoria) kindly supplied me with literature from the library of the Transvaal Museum. Thanks are also due to the referees Prof. Dr. Hans J. Bremer (Melle-Wellingholzhausen) and Dr. Roland Grimm (Tübingen) for their comments and corrections.

2 Check-list of species

Zophosini

Zophosis madagascariensis Deyrolle, 1867: Chatanay (1915), Gebien (1936ff), Koch (1962), Ardoin (1969a), Ferrer (1998).

Tentyriini incl. Epitragini

Craniosphena justi (Fairmaire, 1880): Gebien (1936ff), Koch (1962) from *Himatismus*.
Himatismus buprestoides Gerstaecker, 1862: Koch (1962), Ardoin (1969a), Ferrer (1998).
Himatismus fasciculatus (Fabricius, 1798): Koch (1962), Ardoin (1969a), Ferrer (1998).
Mesostena infima Fairmaire, 1884: Koch (1962) (imported).
Nothrocerus cylindricornis Fairmaire, 1887: Gebien (1936ff), Koch (1962), Ferrer (1998).
Paulianesthes amplipennis Koch, 1962: Koch (1962).
Rhomaleus scauroides Chatanay, 1915: Gebien (1936ff), Koch (1962), Ardoin (1969a).

Adelostomini (= Eurychorini)

Brachymoschium androyanum Koch, 1962: Koch (1962), Ferrer (1998).
Brachymoschium ardoini Koch, 1962: Koch (1962).
Brachymoschium betschi Dajoz, 1979: Dajoz (1979).
Brachymoschium compactum Dajoz, 1982: Dajoz (1982).
Brachymoschium girardi Dajoz, 1979: Dajoz (1979).
Brachymoschium hexagonum Dajoz, 1985: Dajoz (1985).
Brachymoschium minutus Dajoz, 1994: Dajoz (1994), Ferrer (1998).
Brachymoschium parvitarse Fairmaire, 1896: Gebien (1936ff), Koch (1962).
Brachymoschium randriamasyi Koch, 1962: Koch (1962).
Pogonobasis bisulcata Koch, 1952: Koch (1962) (imported).

Stenosini

Anethas longiceps (Fairmaire, 1898): Gebien (1936ff), Koch (1962).
Anethas pauliani Ferreira, 1955: Ferreira (1955), Koch (1962).
Anethas ranavalona Koch, 1962: Koch (1962).
Anethas taitii Ferrer, 1998: Ferrer (1998).
Anethas xylophila Koch, 1962: Koch (1962), Ferrer (1998).
Itampolis oceanica Koch, 1962: Koch (1962).
Perdicus anthrophilus Fairmaire, 1899: Gebien (1936ff), Koch (1962).

Asidini

Andremius crispatus Fairmaire, 1903: Gebien (1936ff), Koch (1962).
Andremius latus Chatanay, 1912: Gebien (1936ff), Koch (1962).
Andremius planatus Chatanay, 1912: Gebien (1936ff), Koch (1962).
Andremiopsis costata Chatanay, 1912: Gebien (1936ff), Koch (1962).
Asidesthes perrieri Fairmaire, 1900: Gebien (1936ff), Koch (1962).
Bartolozzia hispida Ferrer, 1998: Ferrer (1998).
Euryprosternum parallelum (Chatanay, 1912): Gebien (1936ff), Koch (1962).
Euryprosternum asperulum (Fairmaire, 1900): Gebien (1936ff), Koch (1962) from *Scotinesthes*.
Leptasida tenuipes Chatanay, 1914: Gebien (1936ff), Koch (1962).
ssp. *dimorpha* Koch, 1962: Koch (1962).
ssp. *humeralis* Koch, 1962: Koch (1962).
Leptasida vadoni Koch, 1962: Koch (1962).
Machleida nossibiana Fairmaire, 1897: Koch (1962).
Millotella microcornis Koch, 1962: Koch (1962).
Oxyge rugosa Chatanay, 1914: Gebien (1936ff), Koch (1962).
Prosodidius perrieri Fairmaire, 1903: Gebien (1936ff), Koch (1962), Ferrer (1998).
Pseudasida ankaratra Koch, 1962: Koch (1962).
Pseudasida obesa Fairmaire, 1895: Gebien (1936ff), Koch (1962).
Pseudasida pannosa Fairmaire, 1898: Gebien (1936ff), Koch (1962).
Pseudasida peyrierasi Ferrer, 1998: Ferrer (1998).
Scotinesthes acuticosta Fairmaire, 1895: Gebien (1936ff), Koch (1962).
ssp. *ambatolampyensis* Koch, 1962: Koch (1962).
ssp. *perinetensis* Koch, 1962: Koch (1962).
Scotinesthes akisoides Koch, 1962: Koch (1962).
Scotinesthes anosyensis Ardoin, 1976: Ardoin (1976).
Scotinesthes antavarus (Ancey, 1883): Gebien (1936ff), Koch (1962).
Scotinesthes ardoini Koch, 1962: Koch (1962).
Scotinesthes asidinus Fairmaire, 1899: Gebien (1936ff), Koch (1962).
Scotinesthes betschi Ardoin, 1974: Ardoin (1974b).
Scotinesthes costulatus (Fairmaire, 1895): Koch (1962) from *Parecatus*, Ferrer (1998).
Scotinesthes descarpentriesi Ardoin, 1974: Ardoin (1974b).
ssp. *andrianoniensis* Ardoin, 1974: Ardoin (1974b).
Scotinesthes dorsoplicatus (Fairmaire, 1903): Gebien (1936ff), Koch (1962) from *Paracatus*.
Scotinesthes incisicollis (Fairmaire, 1901): Gebien (1936ff), Koch (1962) from *Parecatus*.
Scotinesthes interruptus (Fairmaire, 1901): Gebien (1936ff), Koch (1962) from *Paracatus*.
Scotinesthes machloides (Fairmaire, 1901): Gebien (1936ff), Koch (1962).
Scotinesthes meridionalis Ardoin, 1976: Ardoin (1976).
Scotinesthes montanus Koch, 1962: Koch (1962).
Scotinesthes pauliani Koch, 1962: Koch (1962), Ardoin (1974b).
Scotinesthes plicatulus Fairmaire, 1900: Gebien (1936ff), Koch (1962) from *Parecatus*.
Scotinesthes puncticeps Koch, 1962: Koch (1962).
Scotinesthes subalpinus Koch, 1962: Koch (1962).
Scotinesthes unicostatus Dajoz, 1982: Dajoz (1982).
Scotinesthes voeltzkowi (Wilke, 1921): Gebien (1936ff), Koch (1962) from *Paracatus*.

Tamatasida elegans (Chatanay, 1914): GEBIEN (1936ff), KOCH (1962) from *Scotinesthes*.
Tamatasida tuberculosa (Fairmaire, 1897): GEBIEN (1936ff), KOCH (1962) from *Scotinesthes*.

Molurini

Glyptophrynus cordipennis Koch, 1962: KOCH (1962).
Glyptophrynus madecassus Fairmaire, 1901: GEBIEN (1936ff), KOCH (1962), FERRER (1998).
ssp. *pauliani* Koch, 1962: KOCH (1962).
Glyptophrynus ovipennis (Fairmaire, 1899): GEBIEN (1936ff), KOCH (1962), ARDOIN (1969a).
ssp. *serricostatus* Koch, 1962: KOCH (1962).
Glyptophrynus tenuesculptus (Fairmaire, 1899): GEBIEN (1936ff), KOCH (1962), ARDOIN (1969a), FERRER (1998).
Glyptophrynus voeltzkowi Wilke, 1921: GEBIEN (1936ff), KOCH (1962).

Platynotini

Clastopus aberlenci Iwan, 2005: IWAN (2005).
Clastopus eurynotoides Fairmaire, 1898: GEBIEN (1936ff), FERRER (1998), IWAN (2001, 2005).
Clastopus ordinarius (Iwan, 1996): IWAN (1996) as *Hovademulus*, (2001), (2005).
Clastopus tenuiculus (Iwan, 1996): IWAN (1996) as *Hovademulus*, (2001), (2005).
Doyenus dentatus Iwan, 1996: IWAN (1996).
Doyenus uncus Iwan, 1996: IWAN (1996).
Hovademus andringitrensis Ardoin, 1974: ARDOIN (1974b), IWAN (1996).
Hovademus pauliani Ardoin, 1974: ARDOIN (1974b, 1976), IWAN (1996).
Lechius abacoides (Fairmaire, 1902): GEBIEN (1936ff), IWAN (1995b).
Lechius madagascariensis (Iwan, 1998): IWAN (1998) as *Hovademulus*, (2001).
Lechius steineri Iwan, 1995: IWAN (1995b).
Madobalus rotundicollis Fairmaire, 1901: GEBIEN (1936ff), IWAN (1996).
Melanocratus fairmairei Iwan, 1996: IWAN (1996).
Melanocratus ferreri Iwan, 1996: IWAN (1996), FERRER (1998).
Melanocratus validipes Fairmaire, 1895: GEBIEN (1936ff), ARDOIN (1969a), IWAN (1996) (syn. *humerosus* Fairmaire, 1901), FERRER (1998) as *Styphacus humerosus*.
Phylacinus asperipennis Fairmaire, 1896: GEBIEN (1936ff), FERRER (1998), IWAN (2004b).
Phylacinus ferreri Iwan, 2004: IWAN (2004b).
Phylacinus peyrierasi Ardoin, 1967: ARDOIN (1967), IWAN (2004b).
Pokryszkiella cornuta Iwan, 1996: IWAN (1996).
Sebastianus endroedyi Iwan, 1999: IWAN (1999).
Sebastianus madagascariensis Iwan, 1999: IWAN (1999).
Sebastianus magnus Iwan, 1996: IWAN (1996).
Sebastianus major (Fairmaire, 1899): GEBIEN (1936ff), IWAN (1996).
Sebastianus ovoideus (Fairmaire, 1902): GEBIEN (1936ff), ARDOIN (1969a), IWAN (1996), FERRER (1998).
Sebastianus projectus Iwan, 1996: IWAN (1996).
Sebastianus simplex Iwan, 1996: IWAN (1996).
Styphacus bartolozzii Iwan, 1996: IWAN (1996, 2004a), FERRER (1998).
Styphacus decorsei Fairmaire, 1901: GEBIEN (1936ff); IWAN (1996) (syn. *amplicollis* Fairmaire, 1902 and *convexicollis* Fairmaire, 1902), (2004a); FERRER (1998).
Styphacus drugmandi Iwan, 2004: IWAN (2004a).
Styphacus girardi Iwan, 2004: IWAN (2004a).
Styphacus iwani Ferrer, 2002: FERRER (2002), IWAN (2004a).
Styphacus kochi Iwan, 1996: IWAN (1996, 2004a).
Styphacus neuter (Fairmaire, 1902): GEBIEN (1936ff), IWAN (1996, 2004a).
Styphacus nimius Iwan, 1996: IWAN (1996, 2004a).
Styphacus pauliani Iwan, 2004: IWAN (2004a).
Styphacus phreneticus Iwan, 1996: IWAN (1996, 2004a).
Zidalus attenuatus (Klug, 1833): GEBIEN (1936ff), IWAN (1995a) from *Opatrinus*, FERRER (1998).
Zidalus insularis (Mulsant & Rey, 1853): IWAN (1995a) from *Opatrinus*, FERRER (1998).
Zidalus servus (Mulsant & Rey, 1853): IWAN (2002).

Opatrini

Adavius ovatulus Fairmaire, 1897: FERRER (1998) as *Cyptus*.
Adavius perrieri Fairmaire, 1903: GEBIEN (1936ff), FERRER (1998) as *Cyptus*.
Caedius nodieri Fairmaire, 1893: GEBIEN (1936ff).
Cheirodes sakalava Alluaud, 1900: GEBIEN (1936ff), ARDOIN (1971).
Cheirodes schmitzi (Ardoin, 1971): ARDOIN (1971).
Gonocephalum alluaudi Chatanay, 1915: CHATANAY (1915), GEBIEN (1936ff).
Gonocephalum alticola Chatanay, 1915 [Tanzania].
ssp. *nossibense* Ferrer, 1993: FERRER (1998).
ssp. *sechellense* Ferrer, 1993: FERRER (1998).
Gonocephalum angusticolle (Gerstaecker, 1855): FERRER (2000b).
Gonocephalum (Opatropis) blairi Gebien, 1922: ARDOIN (1969a), FERRER (2000b).
Gonocephalum chatanayi Gebien, 1939: CHATANAY (1915) as *persimile*, GEBIEN (1936ff) (syn. *persimile* Chatanay, 1915), FERRER (1998).
Gonocephalum dermestoides (Gerstaecker, 1871) [East Africa].
ssp. *pupieri* Chatanay, 1913: FERRER (2000b), SMNS det. FERRER.
Gonocephalum foveoseriatum Chatanay, 1915: GEBIEN (1936ff).
Gonocephalum giraudini Ardoin, 1965 [Central and East Africa].
ssp. *rex* Ferrer, 1995: FERRER (2000b).
Gonocephalum kempsteri Ferrer, 2000: FERRER (2000b), SMNS det. FERRER.
Gonocephalum madagascariense Chatanay, 1915: CHATANAY (1915), GEBIEN (1936ff), FERRER (1998).
ssp. *breve* Chatanay, 1915: CHATANAY (1915), GEBIEN (1936ff), FERRER (2000b).
Gonocephalum mariei Chatanay, 1915: CHATANAY (1915), GEBIEN (1936ff).
Gonocephalum marylinnae Ferrer, 2000: FERRER (2000a).
Gonocephalum micantipenne Fairmaire, 1893: CHATANAY (1915), GEBIEN (1936ff).
Gonocephalum peregrinum (Kolbe, 1902): GEBIEN (1936ff).
Gonocephalum simplex (Fabricius, 1801): GEBIEN (1936ff), FERRER (1998, 2000b).
Mesomorphus fulvosulcatus Fairmaire, 1898: GEBIEN (1936ff).
Mesomorphus villiger Blanchard, 1853: GEBIEN (1936ff), FERRER (1998).
Pachymastus asperulus Fairmaire, 1896: GEBIEN (1936ff).
Pachypterus girardi Ferrer, 2000: FERRER (2000a).
Plesioderes brevis Fairmaire, 1903: GEBIEN (1936ff) as *Caedius*, FERRER (1998).
Plesioderes coriaceus Mulsant & Rey, 1860: GEBIEN (1936ff).
Plesioderes freyi Ferrer, 1998: FERRER (1998).

Plesioderes madagascariensis Mulsant & Rey, 1859: Gebien (1936ff), Ardoin (1969a).
Plesioderes oceanicus Ferrer, 1998: Ferrer (1998).
Sulpius ardoini Koch, 1968: Koch (1968), Ardoin (1969a).
Sulpius chatanayi Koch, 1968: Koch (1968), Ardoin (1969a).
Sulpius gibbosus Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Sulpius lilonus Koch, 1968: Koch (1968).
Sulpius mirabilis Koch, 1968: Koch (1968), Ardoin (1969a).
Sulpius oblongulus Chatanay, 1915: Chatanay (1915), Gebien (1936ff), Ardoin (1969a).
Sulpius punctostriatus Fairmaire, 1906: Gebien (1936ff).
Sulpius spinulus Koch, 1968: Koch (1968), Ardoin (1969a), Ferrer (1998).

Leichenini

Leichenum variegatum Klug, 1833: Gebien (1936ff), Ferrer (1998).

Phaleriini

Phaleria batesi Fairmaire, 1875: Gebien (1936ff), Ardoin (1969a).
Phaleria bigoti Ardoin, 1969: Ardoin (1969a), Ferrer (1998).
Phaleria pallida Lewis, 1894: Ardoin (1969a).
Phaleria phalerata Chevrolat, 1878: Ferrer (1998).
ssp. *cinctipennis* Alluaud, 1896: Gebien (1936ff), Ardoin (1969a).
Phaleria prolixa (Fairmaire, 1868): Ardoin (1969a), Ferrer (1998).

Heterocheirini

Diphyrrhynchus aenescens Fairmaire, 1892: Ardoin (1969a).
Diphyrrhynchus effeminatus Gebien, 1922: SMNS det. Schawaller.
Heterocheira ellipsodes (Fairmaire, 1901): Gebien (1936ff) as *Phaleria*, Ardoin (1969a), Ferrer (1998).

Trachyscelini

Trachyscelis esquiveli Koch, 1953: Ardoin (1969a).

Crypticini

Microcrypticus variegatus Klug, 1833: Gebien (1936ff), SMNS det. Schawaller.
Myrmecocatops latus Wasman, 1897: Gebien (1936ff).

Rhipidandrini

Rhipidandrus borbonicus (Fairmaire, 1880): Merkl & Kompantzeva 1996.
Rhipidandrus madagascariensis (Lacordaire, 1866): Gebien (1936ff), doubtful taxon.

Gnathidini

Anommabates griveaudi Dajoz, 1977: Dajoz (1977).
Anommabates kochi Bremer, 1997: Bremer (1997).
Anommabates lucidus Dajoz, 1982: Dajoz (1982).
Anommabates pauliani Koch, 1956: Koch (1956).
Anommabates peyrierasi Dajoz, 1982: Dajoz (1982).
Caecochares cephalotes Koch, 1956: Koch (1956), Ferrer (1998).
Caecochares descarpentriesi Ardoin, 1974: Ardoin (1974b).
Caecochares endroedyi Bremer, 2000: Bremer (2000).
Caecochares franzi Dajoz, 1972: Dajoz (1972).
Caecochares gigas Dajoz, 1972: Dajoz (1972).
Caecochares grjebinei Koch, 1956: Koch (1956).
Caecochares hovanus Bremer, 2000: Bremer (2000).
Caecochares insularis Dajoz, 1977: Dajoz (1977).
Caecochares intermedius Dajoz, 1982: Dajoz (1982).
Caecochares janaki Bremer, 2000: Bremer (2000).
ssp. *merinaensis* Bremer, 2000: Bremer (2000).
Caecochares kaszabi Bremer, 2000: Bremer (2000).
Caecochares merkli Bremer, 2000: Bremer (2000).
Caecochares meridionalis Dajoz, 1994: Dajoz (1994), Ferrer (1998).
Caecochares milloti Koch, 1956: Koch (1956).
Caecochares pierrei Dajoz, 1972: Dajoz (1972).
Caecochares robinsoni Koch, 1956: Koch (1956).
Caecochares serripes Koch, 1956: Koch (1956).
Caecochares subpunctus Koch, 1956: Koch (1956).
Caecochares tibialis Bremer, 2000: Bremer (2000).

Diaperini

Ceropria ellipsodes Fairmaire, 1898: Gebien (1936ff).
Ceropria romandi Laporte & Brullé, 1831: Gebien (1936ff), Ferrer (1998).
Cissides punctatissimus Fairmaire, 1869: Chatanay (1915), Gebien (1936ff).
Heterophylus bimaculatus Pic, 1915: Gebien (1936ff).
Heterophylus chatanayi Pic, 1915: Gebien (1936ff).
Heterophylus chrysomelinus Klug, 1833: Chatanay (1915), Gebien (1936ff), Ferrer (1998).
Heterophylus convexus Pic, 1921: Gebien (1936ff).
Heterophylus curtus Fairmaire, 1869: Chatanay (1915), Gebien (1936ff), Ferrer (1998).
Heterophylus goudoti Fairmaire, 1869: Chatanay (1915), Gebien (1936ff), Ardoin (1974b).
Heterophylus minutissimus Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Heterophylus minutus (Brancsik, 1893): Ardoin (1958f) from *Enicmosoma*.
Heterophylus nitidus Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Heterophylus obesus Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Heterophylus pinguis Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Heterophylus quadrimaculatus Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Heterophylus ruficeps Pic, 1921: Gebien (1936ff).
Heterophylus sikorai Pic, 1921: Gebien (1936ff).
Heterophylus similis Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Heterophylus subseriatus Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Pentaphyllus angustior Fairmaire, 1897: Gebien (1936ff).
Pentaphyllus cornutus Chatanay, 1915: Chatanay (1915), Gebien (1936ff), Ferrer (1998).
Platydema atrum (Motschulsky, 1873): Gebien (1936ff), Schawaller (2004).
Platydema aureolum Chatanay, 1915: Chatanay (1915), Gebien (1936ff), Ferrer (1998), Schawaller (2004).
Platydema cavifrons (Fairmaire, 1895): Chatanay (1915), Gebien (1936ff), Schawaller (2004).
Platydema cercyonoides Fairmaire, 1880: Gebien (1936ff), Ferrer (1998), Schawaller (2004).
Platydema flavofasciatum Chatanay, 1915: Chatanay (1915), Gebien (1936ff), Schawaller (2004).

Platydema inaequidens (Fairmaire, 1880): GEBIEN (1936ff), SCHAWALLER (2004).
Platydema metallicolle Pic, 1953: SCHAWALLER (2004).
Platydema nigellum Chatanay, 1915: CHATANAY (1915), GEBIEN (1936ff), SCHAWALLER (2004).
Platydema palliditarse Laporte & Brullé, 1831: CHATANAY (1915), GEBIEN (1936ff), FERRER (1998), SCHAWALLER (2004).
Platydema raharizoninai Ardoin, 1965: SCHAWALLER (2004).
Platydema rufoviolaceum Chatanay, 1915: CHATANAY (1915), GEBIEN (1936ff), SCHAWALLER (2004).
Platydema tricorne Klug, 1833: GEBIEN (1936ff), FERRER (1998), SCHAWALLER (2004).

Leiochrinini

Leiochrodes hemisphaericus Guérin, 1857: GEBIEN (1936ff).
Leiochrodes vernicatus Fairmaire, 1898: GEBIEN (1936ff).

Phrenapatini

Exechophthalmus guillaumeti Ardoin, 1974: ARDOIN (1974b).
Madagassa aphodina (Fairmaire, 1894): GEBIEN (1936ff) as *Pycna*, FERRER (1998).
Madagassa atra (Pic, 1926): ARDOIN (1976).
Madagassa canaliculata Ardoin, 1974: ARDOIN (1974b), FERRER (1998).
Madagassa macrocephala Ardoin, 1974: ARDOIN (1974b).
Pycna impressifrons Fairmaire, 1897: GEBIEN (1936ff).
Pycna minor Fairmaire, 1897: GEBIEN (1936ff).
Pycna sikorai Pic, 1926: GEBIEN (1936ff).
Pycnochilus advenus Waterhouse, 1879: GEBIEN (1936ff).
Tagalus cavifrons (Fairmaire, 1893): ARDOIN (1974b) from *Pycna*.

Ulomini

Alphitobius crenatus (Klug, 1833): GEBIEN (1936ff), FERRER (1998).
Alphitobius diaperinus (Panzer, 1797): SMNS det. SCHAWALLER.
Alphitobius limbalis Fairmaire, 1901: GEBIEN (1936ff).
Alphitobius grandis Fairmaire, 1897: GEBIEN (1936ff).
Astalbus longicollis Ardoin, 1959: ARDOIN (1959b).
Astalbus scrobicollis Fairmaire, 1894: GEBIEN (1936ff), ARDOIN (1959b), HALSTEAD (1967), DAJOZ (1994), FERRER (1998).
Corticeus angustatus (Pic, 1914): GEBIEN (1936ff), BREMER (1985, 1987).
ssp. *nigromaculatus* (Ardoin, 1970): BREMER (1985).
Corticeus atalante Bremer, 1987: BREMER (1987).
Corticeus camelopardalis Bremer, 1987: BREMER (1987).
Corticeus dryas Bremer, 1987: BREMER (1987).
Corticeus ephippiatus (Gebien, 1911): GEBIEN (1936ff), BREMER (1985).
Corticeus gomyi Bremer, 1995: BREMER (1995), GOMY (2004) (erroneously described from Madagascar, type locality on Réunion).
Corticeus hovanus (Ardoin, 1970): ARDOIN (1970), BREMER (1985).
Corticeus madecassus (Dajoz, 1994): DAJOZ (1994), FERRER (1998).
Corticeus merina Bremer, 1985: BREMER (1985), (1987).
Corticeus nemestrinus Bremer, 1985: BREMER (1985), (1987).
Corticeus nemosomoides (Fairmaire, 1897): GEBIEN (1936ff); BREMER (1985) (syn. *luteosignatus* Pic, 1945), (1987).
Corticeus perrieri (Fairmaire, 1899): GEBIEN (1936ff), BREMER (1985).
Corticeus rufosellatus (Fairmaire, 1880): GEBIEN (1936ff); ARDOIN (1970); BREMER (1985) (syn. *insellatus* Pic, 1914), (1987); FERRER (1998).
Corticeus subalutaceus (Pic, 1924): GEBIEN (1936ff), BREMER (1987) (syn. *radamai* Bremer, 1985).
Corticeus vadoni (Pic, 1945): BREMER (1985), (1987).
Corticeus validus (Fairmaire, 1893): BREMER (1985), (1987).
Corticeus vitiosus Bremer, 1987: BREMER (1987).
Eutochia cistelina Klug, 1833: GEBIEN (1936ff), FERRER (1998).
Eutochia opatrinoides Fairmaire, 1903: GEBIEN (1936ff), FERRER (1998).
Leptoscapha dimidiatipennis Fairmaire, 1880: GEBIEN (1936ff), FERRER (1998).
Leptoscapha spissicornis Fairmaire, 1884: GEBIEN (1936ff).
Lyphia madagascariensis Marseul, 1876: GEBIEN (1936ff).
Palorus cerylonoides (Pascoe, 1863): HALSTEAD (1967).
Palorus mahenus Gebien, 1922: HALSTEAD (1967), DAJOZ (1994), FERRER (1998).
Peltoides hovanus Fairmaire, 1898: GEBIEN (1936ff).
Prolabrus parallelus Fairmaire, 1897: GEBIEN (1936ff), ARDOIN (1959b), HALSTEAD (1967).
Tribolium alcinae Hinton, 1948: HINTON (1948).
Tribolium castaneum (Herbst, 1797): FERRER (1998).
Tribolium ceto Hinton, 1948: HINTON (1948), FERRER (1998).
Tribolium quadricollis (Fairmaire, 1902): HALSTEAD (1967), FERRER (1998) (syn. *dolon* Hinton, 1948).
Ulomoides (= Martianus, Palembus) cinctellus (Fairmaire, 1902): GEBIEN (1936ff).

Cossyphini

Cossyphus madecassus Fairmaire, 1896: GEBIEN (1936ff).

Eutelini

Eutelonotus decurtatus Fairmaire, 1880: GEBIEN (1936ff).
Eutelonotus echinatus Fairmaire, 1896: GEBIEN (1936ff).

Toxicini

Cryphaeus taurus Fabricius, 1801: GEBIEN (1936ff), FERRER (1998).

Tenebrionini

Athrodactyla attenuata Klug, 1833: GEBIEN (1936ff), FERRER (1998).
Athrodactyla elongata Klug, 1833: CHATANAY (1915), GEBIEN (1936ff).
Athrodactyla intermedia Fairmaire, 1868: GEBIEN (1936ff).
Athrodactyla longicollis Chatanay, 1915: CHATANAY (1915), GEBIEN (1936ff), FERRER (1998).
Cedrosius calosomoides Fairmaire, 1902: GEBIEN (1936ff), ARDOIN (1958d).
Cedrosius coerulans Fairmaire, 1903: GEBIEN (1936ff), ARDOIN (1958d).
Derosphaerus globicollis Thomson, 1858: GEBIEN (1936ff), ARDOIN (1957b).
Derosphaerus madecassus Ardoin, 1957: ARDOIN (1957b).
Falsocalcar bicolor Pic, 1925: GEBIEN (1936ff).
Gridellia trivialis (Fairmaire, 1903): GEBIEN (1936ff) as *Villiersia*.
Lordodera quadrihamata (Fairmaire, 1875): CHATANAY (1915) as *Tenebrio*, GEBIEN (1936ff).
Ozaenimorphus angustior Fairmaire, 1896: GEBIEN (1936ff), ARDOIN (1965).
Ozaenimorphus costulipennis Fairmaire, 1882: GEBIEN (1936ff), ARDOIN (1965).
Ozaenimorphus curvipes Ardoin, 1965: ARDOIN (1965).
Ozaenimorphus menephiloides Ardoin, 1965: ARDOIN (1965).
Ozaenimorphus mocquersyi Ardoin, 1965: ARDOIN (1965).
Poeciltoides alternans Fairmaire, 1896: GEBIEN (1936ff).
Satanocalcar cornutus Pic, 1925: GEBIEN (1936ff).
Strepsius spretulus Fairmaire, 1896: GEBIEN (1936ff).

Nycteropini

Macellocerus acuminatus (Klug, 1833): Bates (1879), Gebien (1936ff), Ferrer (1998).
Macellocerus acutipenis Ferrer, 1998: Ferrer (1998).
Macellocerus albignaci Ardoin, 1974: Ardoin (1974b).
Macellocerus ambalamanakanae Ferrer, 1998: Ferrer (1998).
Macellocerus ambiguus Fairmaire, 1895: Gebien (1936ff).
Macellocerus anosyensis Ardoin, 1976: Ardoin (1976).
Macellocerus approximatus (Bates, 1879): Bates (1879) as *Dolichoderus*, Gebien (1936ff).
Macellocerus atroaenescens Fairmaire, 1877: Bates (1879) as *Dolichoderus*, Gebien (1936ff).
Macellocerus batesi Ferrer, 1998: Ferrer (1998).
Macellocerus blanci Ardoin, 1974: Ardoin (1974b).
Macellocerus connexus (Bates, 1879): Bates (1879) as *Dolichoderus*, Gebien (1936ff).
Macellocerus convexipennis Ardoin, 1976: Ardoin (1976).
Macellocerus cyanicollis Ardoin, 1976: Ardoin (1976).
Macellocerus descarpentriesi Ardoin, 1976: Ardoin (1976).
Macellocerus dimidiatus Waterhouse, 1878: Gebien (1936ff).
Macellocerus distinctus (Bates, 1879): Bates (1879) as *Dolichoderus*, Gebien (1936ff).
Macellocerus fuliginosus Ardoin, 1976: Ardoin (1976).
Macellocerus gibbipennis (Bates, 1879): Bates (1879) as *Dolichoderus*, Gebien (1936ff).
Macellocerus griveaudi Ardoin, 1974: Ardoin (1974b).
Macellocerus heterocerus (Bates, 1879): Bates (1879) as *Dolichoderus*, Gebien (1936ff).
Macellocerus klugi Laporte, 1840: Gebien (1936ff).
Macellocerus laticornis Fairmaire, 1884: Gebien (1936ff).
Macellocerus longicornis Fairmaire, 1875: Bates (1879) as *Dolichoderus*, Gebien (1936ff).
Macellocerus lucidipennis Ardoin, 1976: Ardoin (1976).
Macellocerus lucifugus (Bates, 1879): Bates (1879) as *Dolichoderus*, Gebien (1936ff).
Macellocerus marginicollis Ardoin, 1976: Ardoin (1976).
Macellocerus mucronatus (Bates, 1879): Bates (1879) as *Dolichoderus*, Gebien (1936ff).
Macellocerus ocularis Ardoin, 1974: Ardoin (1974b).
Macellocerus olivaceus Ardoin, 1976: Ardoin (1976).
Macellocerus opaculus Fairmaire, 1895: Gebien (1936ff).
Macellocerus pauliani Ardoin, 1974: Ardoin (1974b).
Macellocerus pectoralis (Bates, 1879): Bates (1879) as *Dolichoderus*, Gebien (1936ff).
Macellocerus petiti Ardoin, 1974: Ardoin (1974b).
Macellocerus peyrierasi Ardoin, 1976: Ardoin (1976).
Macellocerus politipennis (Bates, 1879): Bates (1879) as *Dolichoderus*, Gebien (1936ff).
Macellocerus pulchripes (Bates, 1879): Bates (1879) as *Dolichoderus*, Gebien (1936ff).
Macellocerus puncticeps (Bates, 1879): Bates (1879) as *Dolichoderus*, Gebien (1936ff).
Macellocerus ruguliceps Fairmaire, 1895: Gebien (1936ff).
Macellocerus solieri Gebien, 1911: Gebien (1936ff).
Macellocerus specolae Ferrer, 1998: Ferrer (1998).
Macellocerus striatus Laporte, 1840: Gebien (1936ff).
Macellocerus stricticollis Ardoin, 1974: Ardoin (1974b).
Macellocerus subcyaneus Ardoin, 1976: Ardoin (1976).
Macellocerus tibialis Ferrer, 1998: Ferrer (1998).
Macellocerus viettei Ardoin, 1974: Ardoin (1974b).
Macellocerus villiersi Ardoin, 1974: Ardoin (1974b).
Macellocerus violanii Ferrer, 1998: Ferrer (1998).
Nycteropus abbreviatus Fairmaire, 1875: Gebien (1936ff).
Nycteropus anthracinus Klug, 1833: Gebien (1936ff).
Nycteropus attenuatus Fairmaire, 1905: Gebien (1936ff).
Nycteropus bicolor Fairmaire, 1895: Gebien (1936ff).
Nycteropus chalybaeus Fairmaire, 1903: Gebien (1936ff).
Nycteropus chrysochalceus Fairmaire, 1905: Gebien (1936ff).
Nycteropus coelestinus Fairmaire, 1868: Gebien (1936ff).
Nycteropus coeruleipes Fairmaire, 1894: Gebien (1936ff).
Nycteropus coloratus Fairmaire, 1903: Gebien (1936ff).
Nycteropus confusus Bates, 1879: Gebien (1936ff).
Nycteropus coquereli Fairmaire, 1868: Gebien (1936ff).
Nycteropus crassicollis Fairmaire, 1905: Gebien (1936ff).
Nycteropus ebeninus Klug, 1833: Gebien (1936ff).
Nycteropus laevisternus Fairmaire, 1877: Bates (1879), Gebien (1936ff).
Nycteropus obscurocupreus Fairmaire, 1903: Gebien (1936ff).
Nycteropus ovalis Laporte, 1840: Gebien (1936ff).
Nycteropus perrieri Fairmaire, 1903: Gebien (1936ff).
Nycteropus protensus Fairmaire, 1905: Gebien (1936ff).
Nycteropus resplendens Laporte, 1840: Gebien (1936ff).
Nycteropus rufipes Laporte, 1840: Gebien (1936ff).
Nycteropus seriatoporus Fairmaire, 1868: Gebien (1936ff).
Nycteropus splendidus Fairmaire, 1894: Gebien (1936ff).
Nycteropus subcyaneus Fairmaire, 1868: Gebien (1936ff).
Nycteropus suturatus Fairmaire, 1868: Gebien (1936ff).
Nycteropus virescens Fairmaire, 1868: Gebien (1936ff).
Chalcostylus perrieri Fairmaire, 1898: Gebien (1936ff).
Chalcostylus striolatus Fairmaire, 1906: Gebien (1936ff).

Lupropini

Antennoluprops andohahelae (Ferrer, 1998): Ferrer (1998) as *Anaedus*, Schawaller (2007).
Antennoluprops bremeri Schawaller, 2007: Schawaller 2007.
Coxelinus colasi Ardoin, 1956: Ardoin (1956b).
Coxelinus impressipennis Fairmaire, 1869: Gebien (1936ff), Ardoin (1956b).
Coxelinus nossibianus Ardoin, 1956: Ardoin (1956b).
Coxelinus pauliani Ardoin, 1956: Ardoin (1956b).
Coxelinus semiobscurus Ardoin, 1956: Ardoin (1956b).
Coxelinus stricticollis Fairmaire, 1869: Gebien (1936ff), Ardoin (1956b).
Coxelinus subaeneus Ardoin, 1956: Ardoin (1956b).
Enicmosoma crassicorne Ardoin, 1958: Ardoin (1958f).
Enicmosoma decorsei Ardoin, 1958: Ardoin (1958f).
ssp. *haafi* Ardoin, 1964: Ardoin (1964).
Enicmosoma gebieni Ardoin, 1958: Ardoin (1958f).
Enicmosoma lineatum Ardoin, 1958: Ardoin (1958f).
Enicmosoma nebulosum Ardoin, 1958: Ardoin (1958f).
Enicmosoma nitens Ardoin, 1958: Ardoin (1958f).
Enicmosoma punctatissimum Ardoin, 1958: Ardoin (1958f).
Enicmosoma quadrimaculatum Ardoin, 1958: Ardoin (1958f).
Enicmosoma vadoni Ardoin, 1958: Ardoin (1958f).
Luprops hovanus Fairmaire, 1898: Gebien (1936ff), Ferrer (1998).
Luprops madecassus (Chatanay, 1915): Chatanay (1915) as *Lyprops*, Gebien (1936ff).
Microcalcar instriatus (Pic, 1925): Gebien (1936ff) as *Belopus*, Ardoin (1967), Ferrer (1998).
Microcalcar pauliani Ardoin, 1976: Ardoin (1976).

Cnodalonini

Actanorie impressipennis (Fairmaire, 1888): Gebien (1936ff), Ardoin (1956a) from *Callimaria*.
Actanorie longipennis Ardoin, 1974: Ardoin (1974b), Ferrer (1998).

Actanorie obscuricollis (Ardoin, 1955): ARDOIN (1955), ARDOIN (1956a) from *Callimaria*.
Actanorie puncticollis Ardoin, 1974: ARDOIN (1974b), FERRER (1998).
Actanorie sinuaticollis (Pic, 1935): GEBIEN (1936ff), ARDOIN (1956a) from *Callimaria*.
Actanorie undaticollis Fairmaire, 1875: GEBIEN (1936ff), ARDOIN (1956a).
Alcyonotus descarpentriesi Ardoin, 1955: ARDOIN (1955).
Amarsenes grandis Fairmaire, 1889: GEBIEN (1936ff), ARDOIN (1955).
Amarsenes interstitialis Fairmaire, 1895: GEBIEN (1936ff), ARDOIN (1955) (syn. *coerulans* Fairmaire, 1898).
Amarsenes oblongocamelus (Fairmaire, 1877): BATES (1879), GEBIEN (1936ff), ARDOIN (1955).
Asidobothris approximans Fairmaire, 1898: KULZER (1951) from *Suarezius*.
Asidobothris clathrata Fairmaire, 1886: GEBIEN (1936ff), KULZER (1951).
Asidobothris cupripennis Kulzer, 1951: KULZER (1951).
Asidobothris metallescens Fairmaire, 1897: GEBIEN (1936ff), KULZER (1951) from *Suarezius*.
Bradymerus aspericollis Fairmaire, 1868: GEBIEN (1936ff).
Bradymerus convexixollis Fairmaire, 1898: GEBIEN (1936ff).
Bradymerus scotti Gebien, 1922: FERRER (1998).
Camariodes aeneopurpureus Ardoin, 1959: ARDOIN (1959a).
Camariodes aeneus Ardoin, 1959: ARDOIN (1959a).
Camariodes alternicostis Ardoin, 1959: ARDOIN (1959a).
Camariodes costatipennis Ardoin, 1959: ARDOIN (1959a).
Camariodes cryptochromus Ardoin, 1955: ARDOIN (1955), (1959a).
Camariodes foveatus Ardoin, 1974: ARDOIN (1974b).
Camariodes foveipennis Fairmaire, 1898: GEBIEN (1936ff), ARDOIN (1959a).
Camariodes griveaudi Ardoin, 1974: ARDOIN (1974b).
Camariodes helopioides Klug, 1833: GEBIEN (1936ff); ARDOIN (1959a), (1960a) (syn. *coquereli* Fairmaire, 1869).
Camariodes laevis Ardoin, 1974: ARDOIN (1974b).
Camariodes lebisi Ardoin, 1955: ARDOIN (1955), (1959a).
Camariodes longipennis Ardoin, 1955: ARDOIN (1955), (1959a).
Camariodes obscuroaeneus Ardoin, 1959: ARDOIN (1959a).
Camariodes opacicollis Fairmaire, 1895: GEBIEN (1936ff), ARDOIN (1959a) (syn. *suturatus* Fairmaire, 1903).
Camariodes pauliani Ardoin, 1959: ARDOIN (1959a).
Camariodes purpurascens Fairmaire, 1895: GEBIEN (1936ff), ARDOIN (1959a).
Camariodes rufitarsis Klug, 1833: ARDOIN (1959a), (1960a) (syn. *convexicollis* Fairmaire, 1899).
Camariodes thoracicus Coquerel, 1851: GEBIEN (1936ff).
Camariodes vadoni Ardoin, 1955: ARDOIN (1955), (1959a).
Carabelops aenescens Fairmaire, 1899: ARDOIN (1956a).
Carabelops billecocqui (Fairmaire, 1901): GEBIEN (1936ff), ARDOIN (1956a) from *Agraecus*.
Carabelops blapoides (Fairmaire, 1902): GEBIEN (1936ff), ARDOIN (1956a) from *Agraecus*.
Carabelops chalcoides (Fairmaire, 1900): GEBIEN (1936ff), ARDOIN (1956a) from *Agraecus*.
Carabelops perrieri (Fairmaire, 1902): GEBIEN (1936ff), ARDOIN (1956a) from *Agraecus*.
Carabelops semiaenescens (Fairmaire, 1905): GEBIEN (1936ff), ARDOIN (1956a) from *Agraecus*.
Charianus antalahensis Ardoin, 1955: ARDOIN (1955).
Charianus buqueti Coquerel, 1851: GEBIEN (1936ff), ARDOIN (1955).
Charianus nepos (Fairmaire, 1901): ARDOIN (1955) from *Amarsenes*.
Charianus obscuratus Fairmaire, 1894: GEBIEN (1936ff), ARDOIN (1955).
Charianus pierrei Ardoin, 1955: ARDOIN (1955).
Charianus purpuratus (Coquerel, 1851): BATES (1879), GEBIEN (1936ff), ARDOIN (1955) (syn. *cribricollis* Fairmaire, 1898 and *latecincta* Fairmaire, 1899).
Charianus subangulatus (Pic, 1933): ARDOIN (1955) from *Porphyrhyba*.
Charianus violaceipennis Ardoin, 1955: ARDOIN (1955).
Charianus viridipennis (Pic, 1933): ARDOIN (1955) from *Porphyrhyba*.
Chatanayus fragilicornis Ferrer, 1998: FERRER (1998) as *Chatanayum*.
Chatanayus obscurus (Chatanay, 1915): CHATANAY (1915) as *Holobrachys*; GEBIEN (1936ff); ARDOIN (1957a), (1958a) from *Holobrachys*.
Chatanayus purpurata (Klug, 1833): ARDOIN (1955) as *Porphyrhyba*, (1957a), (1958a) from *Holobrachys*, (1960a) (syn. *Chatanayus vicki* Fairmaire, 1901).
Chatanayus spissicornis Ferrer, 1998: FERRER (1998) as *Chatanayum*.
Chatanayus villosipes (Fairmaire, 1884): GEBIEN (1936ff), ARDOIN (1957a), (1958a) from *Holobrachys*.
Chemolanus alluaudi Ardoin, 1956: ARDOIN (1956c).
Chemolanus obscura (Klug, 1833): BATES (1879); GEBIEN (1936ff); ARDOIN (1955), (1956c) (all as *Droclaena*), (1960a), (1961a) (syn. *Chemolanus consobrinus* Fairmaire, 1868).
Chemolanus froussarti Ardoin, 1955: ARDOIN (1955), (1956c).
Chemolanus humeralis Ardoin, 1955: ARDOIN (1955), (1956c).
Chemolanus kulzeri Ardoin, 1956: ARDOIN (1956c).
Chemolanus nitidipennis Chatanay, 1915: CHATANAY (1915), GEBIEN (1936ff), ARDOIN (1956c).
Chemolanus recticollis Fairmaire, 1898: ARDOIN (1956c).
Damatris acerbus Coquerel, 1851: GEBIEN (1936ff), ARDOIN (1958b).
Damatris acidiferus Coquerel; 1851: GEBIEN (1936ff), ARDOIN (1958b).
Damatris alluaudi Ardoin, 1958: ARDOIN (1958b).
Damatris alternicolor Fairmaire, 1895: GEBIEN (1936ff), ARDOIN (1958b).
Damatris balteatus Coquerel, 1851: GEBIEN (1936ff); ARDOIN (1955), (1958b) (var. *pseudobalteatus* Ardoin, 1955).
Damatris bicolor Fairmaire, 1898: GEBIEN (1936ff), ARDOIN (1958b).
Damatris brevis Klug, 1833: BATES (1879) as *Tetraphyllus pyropterus*; Gebien (1936ff) (sub *pyropterus*); Ardoin (1958b), (1960a) (syn. *pyropterus* Fairmaire, 1877).
Damatris camoena Fairmaire, 1897: GEBIEN (1936ff); ARDOIN (1955) (syn. *pyrrhozona* Fairmaire, 1898), (1958b).
Damatris clypealis Fairmaire, 1896: GEBIEN (1936ff), ARDOIN (1955, 1958b).
Damatris coquereli Ardoin, 1955: ARDOIN (1955), (1958b).
Damatris cyaneostriatus Fairmaire, 1896: GEBIEN (1936ff), ARDOIN (1958b).
ssp. *viridipennis* Ardoin, 1967: ARDOIN (1967).
Damatris deyrollei Coquerel, 1851: GEBIEN (1936ff); ARDOIN (1955) (syn. *cyanipennis* Fairmaire, 1895), (1958b).
Damatris distinguendus Fairmaire, 1903: GEBIEN (1936ff), ARDOIN (1958b).
Damatris formosus Laporte & Brullé, 1831: GEBIEN (1936ff), ARDOIN (1958b).
Damatris janthinipennis Ardoin, 1974: ARDOIN (1974b).

Damatris lebisi Ardoin, 1955: Ardoin (1955), (1958b).
Damatris lokobensis Ardoin, 1958: Ardoin (1958b).
Damatris mirificus Coquerel, 1851: Gebien (1936ff), Ardoin (1958b).
Damatris mixticolor Ardoin, 1976: Ardoin (1976).
Damatris oblongus Ardoin, 1955: Ardoin (1955), (1958b).
Damatris obscurus Ardoin, 1955: Ardoin (1955), (1958b).
Damatris parvicollis Fairmaire, 1898: Gebien (1936ff), Ardoin (1958b).
Damatris pauliani Ardoin, 1958: Ardoin (1958b).
Damatris pici Ardoin, 1955: Ardoin (1955), (1958b).
ssp. *episcopalis* Ardoin, 1967: Ardoin (1967).
Damatris pseudocamoena Ardoin, 1955: Ardoin (1955), (1958b).
Damatris ranomandryensis Ardoin, 1976: Ardoin (1976).
Damatris rotundipennis Ardoin, 1955: Ardoin (1955), (1958b).
Damatris similis Fairmaire, 1899: Gebien (1936ff), Ardoin (1958b).
Damatris splendidus Laporte & Brullé, 1831: Gebien (1936ff), Ardoin (1958b) (var. *oberthueri* Ardoin, 1955).
Damatris tristis Ardoin, 1958: Ardoin (1958b).
Damatris tuberculipennis (Bates, 1879): Bates (1879) as *Tetraphyllus*; Gebien (1936ff); Ardoin (1955) (syn. *retrogranatus* Fairmaire, 1902), (1958b), (1974b).
Damatris vadoni Ardoin, 1955: Ardoin (1955), (1958b), Ferrer (1998).
Damatris viridicupreus Ardoin, 1955: Ardoin (1955), (1958b).
Damatris zonulatus Fairmaire, 1901: Gebien (1936ff), Ardoin (1958b).
Drocleana aeneipennis Ardoin, 1955: Ardoin (1955), (1961a).
Drocleana chalcoptera Klug, 1833: Gebien (1936ff); Ardoin (1955), (1960a), (1961a) (syn. *trapezicollis* Fairmaire, 1894).
Drocleana coerulescens Fairmaire, 1901: Gebien (1936ff), Ardoin (1961a).
ssp. *fairmairei* Ardoin, 1955: Ardoin (1955), (1961a).
ssp. *grandicollis* Ardoin, 1961: Ardoin (1961a).
ssp. *inermipennis* Ardoin, 1961: Ardoin (1961a).
Drocleana cottae Fairmaire, 1902: Gebien (1936ff), Ardoin (1961a), Ferrer (1998).
Drocleana dolorosa Fairmaire, 1906: Gebien (1936ff), Ardoin (1961a).
Droclaena klugi Ardoin, 1961: Ardoin (1961a).
ssp. *spinipennis* Ardoin, 1961: Ardoin (1961a).
Drocleana morio Ardoin, 1955: Ardoin (1955), (1961a).
Droclaena oberthueri Ardoin, 1961: Ardoin (1961a).
Drocleana obscurina Fairmaire, 1877: Gebien (1936ff), Ardoin (1961a).
Drocleana parallela Ardoin, 1955: Ardoin (1955), (1961a).
Drocleana parvicollis Fairmaire, 1877: Bates (1879), Gebien (1936ff), Ardoin (1961a).
Drocleana passeti Fairmaire, 1894: Gebien (1936ff), Ardoin (1961a).
Drocleana puberula Ardoin, 1961: Ardoin (1961a), Ferrer (1998).
Drocleana tenuestriata Fairmaire, 1905: Gebien (1936ff), Ardoin (1961a).
Drocleana tuberculata Pic, 1917: Gebien (1936ff), Ardoin (1961a).
Drocleana violaceipennis Waterhouse, 1879: Gebien (1936ff), Ardoin (1961a).
ssp. *nigricans* Ardoin, 1961: Ardoin (1961a, 1976), Ferrer (1998).
Droclaena vohemarensis Ardoin, 1961: Ardoin (1961a).
Euthysternum attenuatum Fairmaire, 1902: Gebien (1936ff), Ardoin (1957b).
Euthysternum coquereli Fairmaire, 1868: Gebien (1936ff), Ardoin (1957b).
Euthysternum cyaneum Chatanay, 1915: Chatanay (1915), Gebien (1936ff), Ardoin (1957b).
Euthysternum episcopale (Fairmaire, 1886): Chatanay (1915), Gebien (1936ff), Ardoin (1957b).
Euthysternum houssayi Chatanay, 1915: Chatanay (1915), Gebien (1936ff), Ardoin (1957b).
ssp. *aeneipennis* Ardoin, 1967: Ardoin (1967).
Euthysternum milloti Ardoin, 1957: Ardoin (1957b).
Euthysternum nitidipes Fairmaire, 1895: Gebien (1936ff), Ardoin (1957b).
Euthysternum perrieri Fairmaire, 1901: Gebien (1936ff), Ardoin (1957b).
Euthysternum subviolaceum Fairmaire, 1895: Ardoin (1957b).
ssp. *laeviceps* Fairmaire, 1902: Gebien (1936ff), Ardoin (1957b).
Falsocamariodes bourgini Ardoin, 1958: Ardoin (1958c).
Falsocamariodes viettei Ardoin, 1955: Ardoin (1955), (1958c).
Holobrachys chemolanoides Ardoin, 1958: Ardoin (1958a).
Holobrachys fusicornis Fairmaire, 1898: Gebien (1936ff), Ardoin (1958a).
Holobrachys granulatus Fairmaire, 1902: Gebien (1936ff), Ardoin (1958a).
Holobrachys haemorrhoidalis (Klug, 1833): Ardoin (1955), (1958a), (1960a) (syn. *Holobrachys minimus* Ardoin, 1955).
Holobrachys heterocerus Fairmaire, 1869: Gebien (1936ff), Ardoin (1958a).
Holobrachys hispidus Ardoin, 1958: Ardoin (1958a).
Holobrachys infimus Fairmaire, 1901: Gebien (1936ff), Ardoin (1958a).
Holobrachys laevis Ardoin, 1958: Ardoin (1958a).
Holobrachys opacus Ardoin, 1958: Ardoin (1958a).
Holobrachys punctatostriatus Chatanay, 1915: Chatanay (1915), Gebien (1936ff), Ardoin (1958a).
Holobrachys rufipes Ardoin, 1958: Ardoin (1958a).
Holobrachys sicardi Ardoin, 1955: Ardoin (1955), (1958a).
Nannocerus madecassus Pic, 1916: Gebien (1936ff).
Neoporphyrhyba chatanayi (Ardoin, 1955): Ardoin (1955), (1956a), (1957b) from *Porphyrhyba*.
Neoporphyrhyba cyaneocuprea (Fairmaire, 1894): Gebien (1936ff); Ardoin (1955), (1956a), (1957b) from *Porphyrhyba*.
Osternus alpinus Ardoin, 1974: Ardoin (1974b).
Osternus alternatus Ardoin, 1974: Ardoin (1974a).
ssp. *opaculus* Ardoin, 1974: Ardoin (1974a).
Osternus alternicolor (Ardoin, 1955): Ardoin (1955) as *Pseudamarsenes*, (1974a).
Osternus batesi (Ardoin, 1955): Ardoin (1955) as *Pseudamarsenes*, (1974a).
Osternus chalcophanus (Fairmaire, 1894): Ardoin (1955) as *Amarsenes*, (1974a) as *Pseudamarsenes*.
Osternus colasi (Ardoin, 1955): Ardoin (1955) as *Pseudamarsenes*, (1974a).
Osternus hovanus Ardoin, 1955: Ardoin (1955), (1974a).
Osternus iricolor Ardoin, 1955: Ardoin (1955), (1974a).
Osternus marginatus Ardoin, 1974: Ardoin (1974a).
Osternus maroantsetrensis (Ardoin, 1955): Ardoin (1955) as *Pseudamarsenes*, (1974a).
Osternus metallicus (Pic, 1923): Gebien (1936ff) as *Microcalydonis*, Ardoin (1974a).
Osternus opacicollis Fairmaire, 1895: Gebien (1936ff), Ardoin (1974a).
Osternus suturatus (Ardoin, 1955): Ardoin (1955) as *Pseudamarsenes*, (1974a).

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Osternus viossati Ardoin, 1974: Ardoin (1974a).
Paulianaria alternicostis Ardoin, 1960: Ardoin (1960c).
Paulianaria cariosicollis Ardoin, 1960: Ardoin (1960c).
Paulianaria mocquerysi Ardoin, 1960: Ardoin (1960c).
Paulianaria sogai Ardoin, 1960: Ardoin (1960c).
Paulianaria strongylioides Ardoin, 1960: Ardoin (1960c).
Porphyrhyba purpurata Klug, 1833: Ardoin (1955).
Porphyrhyba violaceicolor Fairmaire, 1877: Bates (1879); Gebien (1936ff); Ardoin (1955), (1956a) (syn. *Hybocaulus laticornis* Fairmaire, 1895), (1957b).
Proscorus camoena (Fairmaire, 1901): Ardoin (1955) from *Porphyrhyba*.
Proscorus cyaneostriatus Fairmaire, 1901: Gebien (1936ff).
Pseudamarsenes chopardi Ardoin, 1955: Ardoin (1955).
Pseudamarsenes modestus (Fairmaire, 1895): Ardoin (1955) from *Amarsenes*.
Pseudamarsenes purpureolimbatus Ardoin, 1955: Ardoin (1955).
Pseudamarsenes viridistriatus (Fairmaire, 1894): Gebien (1936ff), Ardoin (1955) from *Amarsenes*, Ferrer (1998).
Pseudocamaria alternata Fairmaire, 1875: Gebien (1936ff), Ardoin (1955, 1958e).
Pseudocamaria consobrina Bates, 1879: Bates (1879), Gebien (1936ff), Ardoin (1958e).
Pseudocamaria oblongula Fairmaire, 1875: Gebien (1936ff), Ardoin (1958e).
Pseudocamaria perroti Ardoin, 1955: Ardoin (1955), (1958e).
Pseudoperichilus albolineatus Ardoin, 1972: Ardoin (1972).
Pseudoperichilus antongilensis Ardoin, 1972: Ardoin (1972).
Pseudoperichilus olivaceus Pic, 1921: Gebien (1936ff), Ardoin (1972).
Pseudoperichilus vadoni Ardoin, 1972: Ardoin (1972).
Suarezius cavernosus Fairmaire, 1899: Gebien (1936ff), Kulzer (1951).
Suarezius conformis Kulzer, 1951: Kulzer (1951).
Suarezius confrater Brancsik, 1897: Gebien (1936ff), Kulzer (1951).
Suarezius cupreolus Fairmaire, 1901: Gebien (1936ff), Kulzer (1951).
Suarezius gibbosulus Fairmaire, 1895: Gebien (1936ff), Kulzer (1951).
Suarezius ovipennis Fairmaire, 1902: Gebien (1936ff), Kulzer (1951).
Suarezius sicardi Ardoin, 1955: Ardoin (1955).
Suarezius timarchoides Kulzer, 1951: Kulzer (1951).
Suarezius vadoni Ardoin, 1969: Ardoin (1969b).
Sulpiosoma medquisti Ferrer, 2006: Ferrer (2006).
Thettea tenuitarsis Bates, 1879: Bates (1879), Gebien (1936ff), Ardoin (1976).
Trichodamatris raffrayi Fairmaire, 1884: Chatanay (1915), Gebien (1936ff), Ardoin (1957a).

Laenini

Hovadelium aeneum Ardoin, 1961: Ardoin (1961b), (1974b).
Hovadelium discoidale Ardoin, 1961: Ardoin (1961b), Ferrer (1998).
Hovadelium elongatum Ardoin, 1976: Ardoin (1976).
Mimolaena clarissae Ferrer, 1998: Ferrer (1998).
Mimolaena pauliani Ardoin, 1961: Ardoin (1961b), (1974b).

Misolampini

Asididius convexicollis Fairmaire, 1906: Gebien (1936ff).
Asididius coquereli Fairmaire, 1869: Gebien (1936ff).
Carabelops aenescens Fairmaire, 1899: Gebien (1936ff).
Moromelas foveipennis Fairmaire, 1898: Gebien (1936ff).
Piloxys foveatus Fairmaire, 1895: Gebien (1936ff).
Piloxys perrieri Fairmaire, 1905: Gebien (1936ff).
Sphaerocaulus brevipes (Fairmaire, 1902): Gebien (1936ff) as *Osdara*, Ardoin (1975).
Sphaerocaulus denticollis Ardoin, 1975: Ardoin (1975).
Sphaerocaulus descarpentriesi Ardoin, 1976: Ardoin (1976).
Sphaerocaulus echidna Fairmaire, 1906: Gebien (1936ff), Ardoin (1975).
Sphaerocaulus graniger Fairmaire, 1869: Gebien (1936ff), Ardoin (1975).
Sphaerocaulus granulatus Ardoin, 1975: Ardoin (1975).
Sphaerocaulus hovanus (Fairmaire, 1902): Gebien (1936ff) as *Osdara*, Ardoin (1975).
Sphaerocaulus laevicollis Fairmaire, 1903: Gebien (1936ff), Ardoin (1975).
Sphaerocaulus longipes Ardoin, 1975: Ardoin (1975).
Sphaerocaulus pauliani Ardoin, 1974: Ardoin (1974b), (1975).
Sphaerocaulus perrieri Fairmaire, 1902: Gebien (1936ff), Ardoin (1975).
Sphaerocaulus pyriformis Ardoin, 1975: Ardoin (1975).
Sphaerocaulus rotundipennis Ardoin, 1976: Ardoin (1976).
Sphaerocaulus sogai Ardoin, 1975: Ardoin (1975).
Sphaerocaulus vadoni Ardoin, 1975: Ardoin (1975).

Amarygmini

Hoplobrachium dentipes Fabricius, 1781: Gebien (1936ff).
Hovamarygmus insularis Fairmaire, 1898: Gebien (1936ff).
Sphaeromatris aurovittata Fairmaire, 1899: Gebien (1936ff).

Strongyliini

Anarmastodera acutipennis Ardoin, 1960: Ardoin (1960b).
Anarmastodera aenea Ardoin, 1960: Ardoin (1960b).
Anarmostodera crassicornis Fairmaire, 1897: Gebien (1936ff), Ardoin (1960b).
Anarmastodera sicardi Ardoin, 1960: Ardoin (1960b).
Anarmastodera vadoni Ardoin, 1960: Ardoin (1960b).
Apterogena canonnei Ardoin, 1962: Ardoin (1962).
Asthenopoda acutipennis Fairmaire, 1869: Gebien (1936ff).
Asthenopoda fragilis Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Asthenopoda villosipes Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Hyperchalca aenescens Fairmaire, 1869: Gebien (1936ff).
Hyperchalca apicalis Pic, 1935: Gebien (1936ff).
Hyperchalca armata Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Hyperchalca fuscoaenea Fairmaire, 1894: Gebien (1936ff).
Hyperchalca humbloti Fairmaire, 1894: Gebien (1936ff).
Hyperchalca levyi Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Hyperchalca lucida Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Hyperchalca nigra Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Hyperchalca nitidicollis Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Hyperchalca rudicollis Fairmaire, 1902: Gebien (1936ff).
Hyperchalca rufiventris Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Hyperchalca sikorai Pic, 1935: Gebien (1936ff).
Hyperchalca viridipennis Ardoin, 1974: Ardoin (1974b).
Mictopsis laticollis Fairmaire, 1899: Gebien (1936ff).

Mictopsis longicornis Pic, 1917: Gebien (1936ff).
Miotodera funeraria Fairmaire, 1901: Gebien (1936ff).
Nesogena aeneipennis Fairmaire, 1868: Chatanay (1915), Gebien (1936ff).
Nesogena andringitrensis Ardoin, 1974: Ardoin (1974b).
Nesogena ardoini Froussart, 1961: Froussart (1961).
Nesogena basicollis Fairmaire, 1903: Gebien (1936ff), Froussart (1961).
Nesogena batesi Fairmaire, 1875: Gebien (1936ff), Froussart (1961).
Nesogena bourgini Froussart, 1961: Froussart (1961).
Nesogena brittoni Froussart, 1961: Froussart (1961).
Nesogena caeruleata Fairmaire, 1896: Gebien (1936ff).
Nesogena castaneipes Bates, 1879: Bates (1879), Gebien (1936ff), Froussart (1961).
Nesogena chopardi Froussart, 1961: Froussart (1961).
Nesogena colasi Froussart, 1961: Froussart (1961).
Nesogena convexa Froussart, 1961: Froussart (1961).
Nesogena coquereli Fairmaire, 1868: Gebien (1936ff).
Nesogena croesus Bates, 1879: Gebien (1936ff).
Nesogena cyanescens Fairmaire, 1899: Gebien (1936ff).
Nesogena cyanipennis Fairmaire, 1906: Gebien (1936ff), Froussart (1961).
Nesogena descarpentriesi Froussart, 1961: Froussart (1961).
Nesogena dimorpha Froussart, 1961: Froussart (1961).
Nesogena episcopalis Fairmaire, 1875: Gebien (1936ff), Froussart (1961) (syn. *violacea* Fairmaire, 1903).
Nesogena fairmairei Bates, 1879: Bates (1879), Gebien (1936ff), Froussart (1961).
Nesogena fastidiosa Fairmaire, 1894: Gebien (1936ff).
Nesogena femorata Froussart, 1961: Froussart (1961).
Nesogena flavicrus Ardoin, 1974: Ardoin (1974b).
Nesogena flavipes Froussart, 1961: Froussart (1961).
Nesogena geniculata Bates, 1879: Bates (1879), Gebien (1936ff), Froussart (1961).
Nesogena gigantea Bates, 1879: Bates (1879), Gebien (1936ff), Froussart (1961).
Nesogena goudoti Fairmaire, 1868: Gebien (1936ff), Froussart (1961).
Nesogena griveaudi Ardoin, 1976: Ardoin (1976).
Nesogena guerini Coquerel, 1851: Gebien (1936ff), Froussart (1961).
Nesogena haagi Bates, 1879: Bates (1879), Gebien (1936ff), Froussart (1961) (syn. *cottae* Fairmaire, 1899).
Nesogena humerosa Fairmaire, 1894: Gebien (1936ff), Ardoin (1974b).
Nesogena hybrida Mäklin, 1863: Gebien (1936ff).
Nesogena hypocyanea Fairmaire, 1899: Gebien (1936ff).
Nesogena intermedia Fairmaire, 1875: Gebien (1936ff).
Nesogena iodolimbata Fairmaire, 1868: Gebien (1936ff), Froussart (1961).
Nesogena lebisi Froussart, 1961: Froussart (1961).
Nesogena longicornis Fairmaire, 1895: Froussart (1961).
Nesogena longula Pic, 1909: Gebien (1936ff).
Nesogena lucida Bates, 1879: Bates (1879), Gebien (1936ff), Froussart (1961).
Nesogena micanticollis Fairmaire, 1896: Gebien (1936ff).
Nesogena minima Froussart, 1961: Froussart (1961).
Nesogena monticola Ardoin, 1974: Ardoin (1974b).
Nesogena oberthueri Froussart, 1961: Froussart (1961).
Nesogena obscuricollis Froussart, 1961: Froussart (1961).
Nesogena obscurina Fairmaire, 1899: Gebien (1936ff), Froussart (1961).
Nesogena obscuripes Fairmaire, 1894: Gebien (1936ff).
Nesogena obscurovirens Fairmaire, 1906: Gebien (1936ff), Ferrer (1998).
Nesogena parallela Froussart, 1961: Froussart (1961).
Nesogena parvicollis Fairmaire, 1875: Gebien (1936ff).
Nesogena pauliani Froussart, 1961: Froussart (1961).
Nesogena pierrei Froussart, 1961: Froussart (1961).
Nesogena rufimembris Fairmaire, 1899: Chatanay (1915), Gebien (1936ff).
Nesogena rufiventris Fairmaire, 1875: Gebien (1936ff), Froussart (1961), Ferrer (1998).
Nesogena rutilia Bates, 1879: Bates (1879), Gebien (1936ff), Froussart (1961).
Nesogena seguyi Froussart, 1961: Froussart (1961).
Nesogena speciosa Bates, 1879: Bates (1879), Gebien (1936ff), Froussart (1961).
Nesogena striata Froussart, 1961: Froussart (1961).
Nesogena subaenea Froussart, 1961: Froussart (1961).
Nesogena superba Froussart, 1961: Froussart (1961).
Nesogena suturata Fairmaire, 1895: Gebien (1936ff), Froussart (1961).
Nesogena testaceipes Fairmaire, 1868: Gebien (1936ff).
Nesogena vadoni Froussart, 1961: Froussart (1961).
Nesogena varians Fairmaire, 1875: Gebien (1936ff).
Nesogena varicolor Bates, 1879: Bates (1879), Gebien (1936ff), Froussart (1961).
Nesogena venusta Bates, 1879: Bates (1879), Gebien (1936ff), Froussart (1961).
Nesogena viettei Froussart, 1961: Froussart (1961).
Nesogena viridiceps Pic, 1909: Gebien (1936ff).
Nesogena viridicoerulea Froussart, 1961: Froussart (1961).
Nesogena viridicuprea Fairmaire, 1868: Chatanay (1915), Gebien (1936ff).
Nesogena viridis Froussart, 1961: Froussart (1961).
Praeugena longipennis Fairmaire, 1889: Gebien (1936ff).
Praeugena nobilis Mäklin, 1863: Gebien (1936ff) as *P. purpurina* Fairmaire, 1868.
Pseudogena alternans Fairmaire, 1903: Gebien (1936ff).
Pseudogena bitincta Fairmaire, 1902: Gebien (1936ff).
Pseudogena inaequalis Fairmaire, 1902: Gebien (1936ff).
Pseudogena laevestriata Fairmaire, 1901: Gebien (1936ff).
Pseudogena lucidicollis Fairmaire, 1884: Chatanay (1915), Gebien (1936ff), Ferrer (1998).
Pseudogena polyzona Fairmaire, 1899: Gebien (1936ff).
Pseudogena semiopaca Fairmaire, 1905: Gebien (1936ff).
Pseudogena spinipes Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Pseudogena tenuestriata Chatanay, 1915: Chatanay (1915), Gebien (1936ff).
Psilonesogena descarpentriesi Ardoin, 1974: Ardoin (1974b).
Psilonesogena hybrida Bates, 1879: Bates (1879), Chatanay (1915), Gebien (1936ff).
Strongylium aenescens Fairmaire, 1902: Gebien (1936ff).
Strongylium cupripenne Mäklin, 1864: Chatanay (1915), Ferrer (1998).
Strongylium fuscoaenescens Fairmaire, 1906: Gebien (1936ff).
Strongylium madagascariense Gebien, 1943: Gebien (1936ff) (syn. *interstitiale* Fairmaire, 1903).
Strongylium purpureipenne Mäklin, 1864: Gebien (1936ff).
Strongylium rudicolle Fairmaire, 1868: Gebien (1936ff).
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New and poorly known Alticinae (Coleoptera: Chrysomelidae) from New Guinea and islands of Southeast Asia

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Abstract

One new genus and 17 new species of the chrysomelid subfamily Alticinae are described: *Neorthella rufofulva* **n. gen., n. sp.** (Borneo), *Acrocrypta doeberli* **n. sp.** (Borneo), *Chabria convexissima* **n. sp.**, *C. iriana* **n. sp.**, *C. papuana* **n. sp.**, *C. riedeli* **n. sp.** (all New Guinea), *Ivalia ornata* **n. sp.** (Borneo), *Sphaeroderma septempunctatum* **n. sp.** (Borneo), *S. ovatomaculatum* **n. sp.** (Bali), *Sutrea antennata* **n. sp.** (Borneo), *S. kolibaci* **n. sp.**, *S. nigricornis* **n. sp.**, *S. nigripes* **n. sp.**, *S. quadripustulata* n. sp., *S. weigeli* **n. sp.** (all New Guinea), *S. riedeli* **n. sp.** (Maluku), and *Orthaltica riedeli* **n. sp.** (New Guinea). New synonym: *Chabria media* Weise, 1913 = *C. angulicornis* Clark, 1865. A key to the New Guinean species of the genus *Sutrea* Baly is given.

K e y w o r d s : Chrysomelidae, Alticinae, New Guinea, Oriental region, new taxa, new synonymy.

Zusammenfassung

Eine neue Gattung und 17 neue Arten der Chrysomeliden-Subfamilie Alticinae werden beschrieben: *Neorthella rufofulva* **n. gen., n. sp.** (Borneo), *Acrocrypta doeberli* **n. sp.** (Borneo), *Chabria convexissima* **n. sp.**, *C. iriana* **n. sp.**, *C. papuana* **n. sp.**, *C. riedeli* **n. sp.** (alle Neuguinea), *Ivalia ornata* **n. sp.** (Borneo), *Sphaeroderma septempunctatum* **n. sp.** (Borneo), *S. ovatomaculatum* **n. sp.** (Bali), *Sutrea antennata* **n. sp.** (Borneo), *S. kolibaci* **n. sp.**, *S. nigricornis* **n. sp.**, *S. nigripes* **n. sp.**, *S. quadripustulata* n. sp., *S. weigeli* **n. sp.** (alle Neuguinea), *S. riedeli* **n. sp.** (Maluku), und *Orthaltica riedeli* **n. sp.** (Neuguinea). Neues Synonym: *Chabria media* Weise, 1913 = *C. angulicornis* Clark, 1865. Ein Bestimmungsschlüssel für die Arten von *Sutrea* Baly von Neuguinea wird gegeben.

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1 Introduction

Alticinae of the Oriental region and from New Guinea are still insufficiently studied. Intensive collecting in these areas during the last years resulted in the descriptions of numerous new species and genera.

The present paper is mostly based on materials from the Staatliches Museum für Naturkunde in Stuttgart. As a result of this investigation, one genus and 17 species are described as new to science. In addition, notes are given on a few poorly known species, and a key for the New Guinean species of the genus *Sutrea* is provided.

Acronyms of depositories

LM	Collection of L. Medvedev, Moscow, Russia
NMEG	Naturkundemuseum, Erfurt, Germany
SMNS	Staatliches Museum für Naturkunde, Stuttgart, Germany

Acknowledgements

I am grateful to Dr. Wolfgang Schawaller (SMNS) and Dr. Matthias Hartmann (NMEG) for the possibility to study the material under their care. Special thanks are extended to J. Reibnitz (SMNS) who prepared the photographs of the present paper by using a Leica DFC 480 digital camera on a Leica MZ16 APO microscope. I also thank the referees for their comments and advice.

2 Taxonomy

2.1 Genus *Neorthella* **n. gen.**

Type species: *Neorthella rufofulva* n. sp.

Etymology

The name refers to the similarity to the genus *Neorthana* L. Medvedev, 1996.

Description

Body ovate, strongly convex. Clypeus triangular, prolonged between antennal insertions as a narrow sharp ridge, delimited laterally by longitudinal grooves for the basal segments of the antennae; interantennal space narrow, vertex triangular, prolonged anteriorly in a narrow sharp ridge connecting with clypeus ridge; wide and deep excavations between vertex and inner margin of eyes, frontal tubercles absent (Fig. 1). Prothorax convex, without any impressions, with basal lobe and thickened anterior angles, bearing a pore. Elytra with regular rows of punctures, confused behind the middle, but punctures mostly not impressed, appearing as dark dots; humeral tubercles weak, basal convexity absent. Anterior coxal cavities open, prosternum wide. Metasternum relatively short. Abdominal sternite 1 with two long and sharp ridges in the middle. Tibiae with flattened and slightly concave upperside, spurs short. Tarsi long, segment 1 of hind tarsus thin, as long as half of tibia, segment 3 distinctly bilobed. Claws appendiculate.

Diagnosis

This new genus resembles *Neorthana* L. Medvedev, 1996. It differs in the shape of clypeus and vertex, the narrow interantennal space, the sculpture of prothorax and elytra and the open anterior coxal cavities. It is apparently very similar to *Lanka* Maulik, 1926, but differs in the absence of frontal tubercles and the different shape of vertex and clypeus.

Neorthella rufofulva **n. sp.**
(Figs. 1, 2, 14, 33)

Holotype (♂): Borneo, Sabah, Batu Punggul Resort, 24.VI.–1.VII.1996, leg. J. Kodada (SMNS).

Etymology

The species name refers to the colouration of the body.

Description

Red fulvous; antennae black with 3 basal segments fulvous and 2 apical segments white; subhumeral spot and a transverse, poorly delimited band in the middle of the elytra black (Fig. 14).

Head shining, impunctate, grooved areas microsculptured. Antennae reaching to the middle of the elytra, proportions of segments 12-6-7-8-8-8-9-9-9-7-9, preapical segments about twice as long as wide. Prothorax 1.8 times as wide as long, lateral margins from base to pore straight, surface shining and impunctate. Scutellum small, triangular. Elytra 1.2 times as long as wide, surface shining, rows of punctures not quite regular, scutellar row long, about one third of elytral length. Segment 1 of fore and mid tarsi distinctly widened. Aedeagus see Fig. 2. Body length 3.5 mm.

2.2 Genus *Acrocrypta* Baly, 1862

Acrocrypta doeberli **n. sp.**
(Figs. 15, 30)

Holotype (♂): Borneo, Sabah, Kinabalu N. P., Sayap, 1000 m, 28.XI.1996, leg. D. Grimm (SMNS).

Etymology

The name of the new species is dedicated to Manfred Döberl (Abensberg), a well known specialist on Alticinae, who revised this genus.

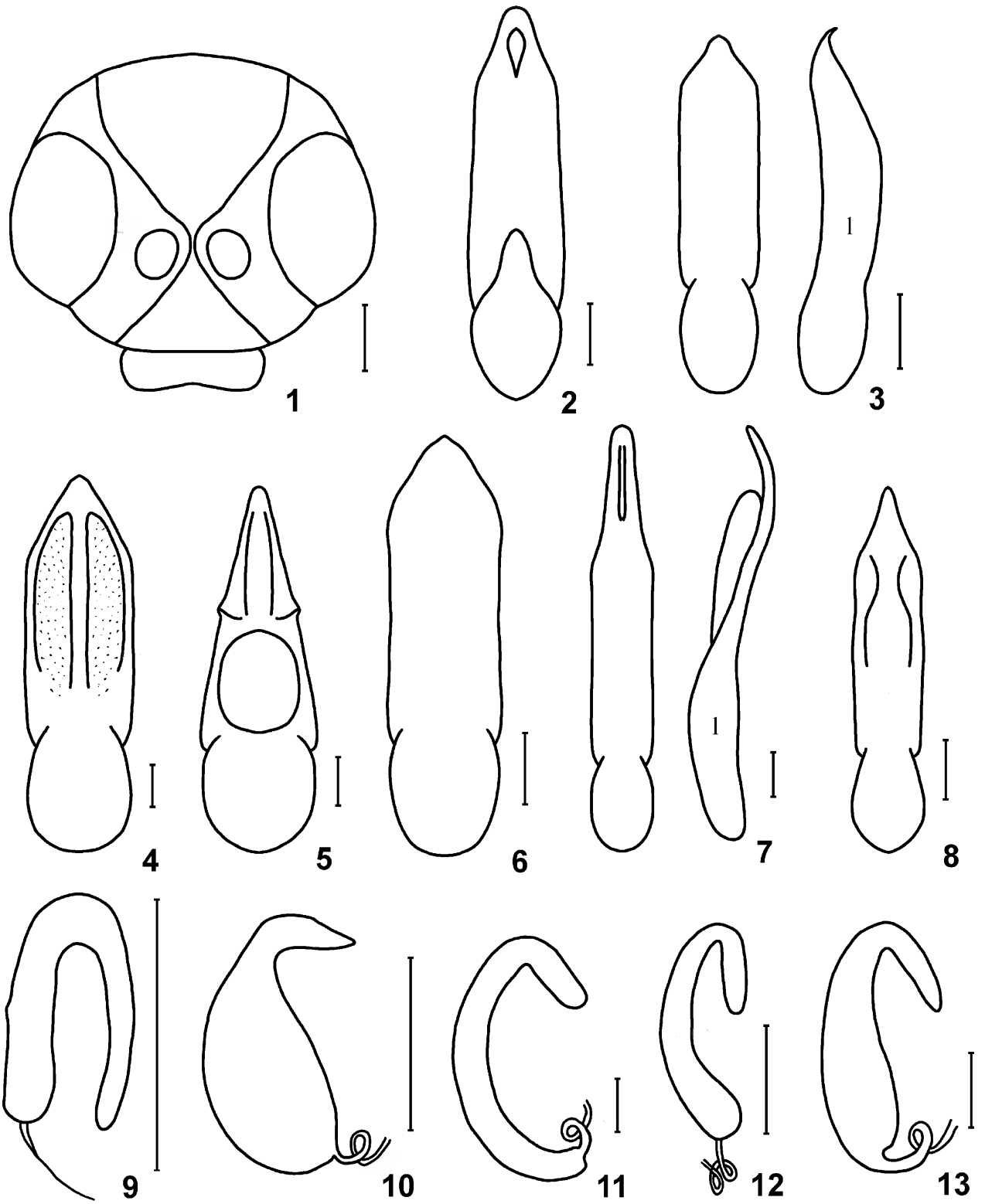
Description

Fulvous; antennae black with 3 basal and 2 apical segments fulvous; elytra with basal margin (wider on humeral area), anterior third of suture and narrow transverse band in the middle (not reaching suture) black (Figs. 15, 30).

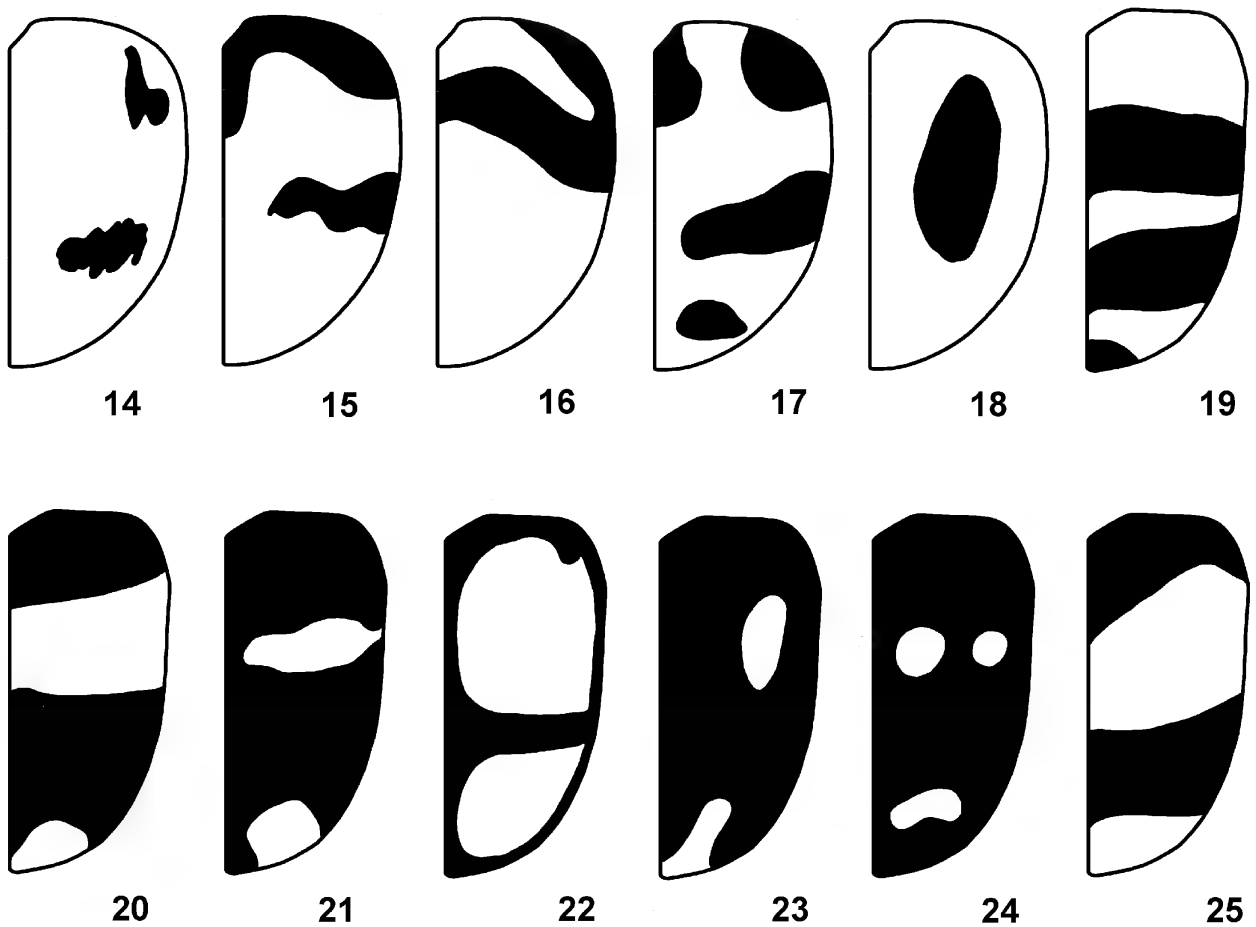
Body ovate, moderately convex. Head impunctate, shining. Frontal tubercles flat, transverse, quadrangular, delimited posteriorly by a straight, slightly impressed line. Antennae reaching to the anterior third of the elytra, proportions of segments 8-3-4-6-6-5-5-5-5-5-7, preapical segments about 2.5 times as long as wide. Prothorax twice as wide as long, widest behind the middle, lateral margins slightly rounded, anterior angles not produced, with a distinct pore, surface shining and impunctate. Scutellum triangular with rounded apex. Elytra 1.2 times as long as wide, finely (especially on apical slope) and densely punctate. Segment 1 of anterior tarsi not widened. Aedeagus (lost during preparation) thin, stick-like, with truncate apex. Body length 4.0 mm.

Diagnosis

The new species belongs to a group with spotted elytra (see Döberl 2001). Having a black anterior part of the suture, it is similar to *A. medvedevi* Döberl, 2001, but it clearly differs in its elytral pattern (Fig. 15).



Figs. 1–13. Alticinae, head (1), aedeagus, ventral and lateral (= l) views (2–8), spermatheca (9–13). – **1**. *Neorthella rufofulva* n. gen., n. sp. **2**. *Neorthella rufofulva* n. sp. **3**. *Chabria iriana* n. sp. **4**. *Chabria angulicornis* Clark. **5**. *Sutrea nigricornis* n. sp. **6**. *Sutrea antennata* n. sp. **7**. *Sutrea weigeli* n. sp. **8.** *Sutrea marginipennis* Jacoby. **9**. *Chabria riedeli* n. sp. **10**. *Sphaeroderma septempunctatum* n. sp. **11**. *Sutrea riedeli* n. sp. **12**. *Sutrea punctipennis* Weise **13**. *Sutrea marginipennis* Jacoby. – Scales: 0.2 mm.



Figs. 14–25. Alticinae, pattern of right elytron. – **14**. *Neorthella rufofulva* n. sp. **15**. *Acrocrypta doeberli* n. sp. **16**. *Ivalia ornata* n. sp. **17**. *Sphaeroderma septempunctatum* n. sp. **18**. *Sphaeroderma ovatomaculatum* n. sp. **19**. *Sutrea kolibaci* n. sp. **20–21**. *Sutrea nigricornis* n. sp. **22**. *Sutrea quadripustulata* n. sp. **23**. *Sutrea antennata* n. sp. **24**. *Sutrea weigeli* n. sp. **25**. *Sutrea riedeli* n. sp.

2.3 Genus *Chabria* Jacoby, 1887

Chabria angulicornis (Clark, 1865) (Fig. 4)

Argopus angulicornis Clark, 1865
Dimax media Weise, 1913.
Chabria media (Weise, 1913) (**n. syn.**).

Material examined

Borneo, Sabah, Batu Punggul Resort, 24.VI.–1.VII.1996, leg. J. Kodada, 1 ♂ (SMNS). – NW Borneo, Sarawak, Belaga, 15.III.1990, leg. A. Riedel, 1 ♂ (SMNS). – Malaysia, Pahang Prov., Kuala Lipis, 9.VII.2004, leg. M. Gaiser, 1 ♀ (SMNS). – Malaysia, Jahor, Endau-Rompin, Pulau Jasin, 50–400 m, 19.III.1998, leg. L. Dembický & P. Pacholátko, 1 ♀ (SMNS). – Malaya, 1 ♀ (LM). – Singapore, 1898, leg. L. Biro, 1 ♂, 1 ♀ (LM). – Malaysia, Benom Mts., 15 km E Kampong Dong, 700 m, 1.IV.1998, leg. L. Dembický & P. Pacholátko, 1 ♀ (LM). – S Thailand, Satun Prov., Thale Ban (6°45'N 100°09'E), 200 m, 8.–13.IV.1997, leg. J. Kolibáč, 1 ♂ (LM). – N Palawan, Bacuit, XII.1913, leg. G. Roettcher, 2 ♂♂, 1 ♀ (LM). – Palawan, Port Barton, 150 m, 14.–18.XII.1990, leg. Bolm, 1 ♂ (LM). – First record for Thailand.

Remark

Chabria media (Weise, 1913) is a new synonym of *C. angulicornis* (Clark, 1865). *C. angulicornis* was described from Borneo and Singapore, *C. media* from Palawan. Both nominal species are morphologically identical in colouration and in shape and structure of the aedeagus which has two wide unsclerotized stripes on its underside, divided by a narrow central stripe (Fig. 4).

Chabria convexissima **n. sp.** (Fig. 26)

Holotype (♀): New Guinea, Irian Jaya, Anggi, Tetaho Iranmeba, 1500–1700 m, 25.III.1993, leg. A. Riedel (SMNS).

Etymology

The species name refers to the very convex body.

Description

Dark violaceous; antennae piceous with 2 apical segments pale flavous; underside and legs mostly black.

Head densely microsculptured (except flat and shining frontal tubercles), clypeus and vertex without longitudinal impression. Antennae reaching to the base of the elytra, proportions of segments 6-3-7-5-4-4-5-5-6-7-10, preapical segments about 1.5 times as long as wide. Prothorax twice as wide as long, basal margin strongly arcuate, lateral margins slightly rounded, with a large pore before the middle and a small one at the hind angles, anterior angles triangularly rounded, hind angles obtuse; surface impunctate, densely microsculptured, with a sharp groove from anterior pore to anterior margin, dividing a rather large triangular area behind the anterior angles; there is also a very weak impression more or less parallel to the lateral margin. Scutellum triangular, microsculptured. Elytra very strongly convex, with maximal convexity in the middle, 0.95 times as long as wide and 1.35 times as long as high, surface very densely microsculptured; apical slope almost vertical, impressed along suture, apices attenuate. Hind tibiae with long spurs. Body length 4.0 mm.

Diagnosis

This new species differs from all known metallic coloured species in its unusually convex elytra, in the densely microsculptured upperside, and in the unusual sculpture of the prothorax.

Chabria iriana **n. sp.**
(Figs. 3, 28)

Holotype (♂): New Guinea, Irian Jaya, Anggi, Tetaho Iranmeba, 1500–1700 m, 25.III.1993, leg. A. Riedel (SMNS).

Paratypes: Same data as holotype, 2 ex. (SMNS, LM). – New Guinea, Irian Jaya, Jayawijaya, Djuremna, 1900–2100 m, 9.–11.IX.1992, leg. A. Riedel, 3 ex. (2 SMNS; 1 LM). – Papua New Guinea, Morobe, Finschhafen, Sattelberg, 100–800 m, 18.X.1992, leg. A. Riedel, 1 ex. (SMNS).

Etymology

The species name is derived from Irian (Jaya).

Description

Bluish black, underside mostly black; antennae pale fulvous.

Head impunctate, interantennal space wide, with longitudinal groove, frons with a rounded groove, frontal tubercles indistinct. Antennae reaching to the humeral tubercle, proportions of segments 9-4-5-4-3-5-5-5-6-5-8, preapical segments about 1.5 times as long as wide. Prothorax twice as wide as long, basal margin strongly arcuate, lateral margins and hind angles rounded, surface moderately convex, impunctate, densely microsculptured, with lateral callus in anterior half. Scutellum triangular, microsculptured. Elytra 1.15 times as long as wide, widest behind the middle, surface convex, densely punctate. Wings present, but relatively short. Spur of hind tibia thin and long. Aedeagus see Fig. 3. Body length 2.9–3.3 mm.

Diagnosis

This new species is similar to *C. nigroviolacea* L. Medvedev, 2008 from Celebes, but it clearly differs in having the antennae pale fulvous and the prothorax with distinct lateral callus.

Chabria papuana **n. sp.**
(Fig. 27)

Holotype (♀): Papua New Guinea, Morobe, Finschhafen, Sattelberg, 100–800 m, 18.X.1992, leg. A. Riedel (SMNS).

Etymology

The species name is derived from Papua (New Guinea).

Description

Dark bronze; antennae black with 4 basal segments fulvous and apical segment piceous; legs dark fulvous with piceous hind femora.

Head impunctate, shining, with a very distinct longitudinal impression from clypeus to vertex, frontal tubercles indistinct. Antennae reaching to the base of the elytra, proportions of segments 10-4-5-4-3-4-5-4-5-5-8, preapical segments about as long as wide, segments 6–11 distinctly thickened. Prothorax twice as wide as long, basal margin strongly arcuate, lateral margins rounded, with a large pore in the middle, anterior angles acute, hind angles obtuse, with pore and bristle, surface moderately convex, shining, with sparse minute punctures and lateral callus, wide anteriorly and disappearing near middle; there is also another impressed line, more or less parallel to lateral margin. Scutellum triangular, shining. Elytra 1.2 times as long as wide, widest in the middle, finely punctate. Spur of hind tibia thin and long. Body length 3.6 mm.

Diagnosis

This new species clearly differs from *C. iriana* in the colouration of the antennae, different shape and sculpture of the prothorax and finely punctate elytra.

Chabria riedeli **n. sp.**
(Figs. 9, 29)

Holotype (♀): New Guinea, Irian Jaya, Jayawijaya, Djuremna, 1900–2100 m, 9.–11.IX.1992, leg. A. Riedel (SMNS).

Etymology

The name of this species is dedicated to its collector, Dr. Alexander Riedel (Karlsruhe).

Description

Piceous to black with weak metallic blue luster; antennae with segments 1–4 fulvous, 5–8 piceous, 9–11 pale flavous; underside piceous, legs fulvous.

Head shining, very finely and sparsely punctate, interantennal space as wide as length of basal antennal segment, longitudinally concave, frontal tubercles absent, vertex excavated near eyes. Antennae reaching to the humeral area of the elytra, proportions of segments 11-6-5-4-4-4-5-5-5-6-8, preapical segments as wide as long. Prothorax twice as wide as long, basal margin strongly arcuate, lateral margins practically not divided from hind margin, with a large pore placed in the middle, anterior angles obtuse, surface shining, very finely and sparsely punctate, with narrow elevated lateral callus, sharply delimited from main surface. Scutellum triangular, smooth and shining. Elytra 1.1 times as long as wide, strongly convex, shining, with fine and moderately dense confused punctures. Wings present. Anterior coxal cavities open. Anterior process of the first abdominal sternite with two ridges. Third segment of tarsi as wide as or slightly wider than preceding one, slightly emarginated at apex, but not bilobed. Spermatheca see Fig. 9. Body length 2.5 mm.

Diagnosis

This new species is similar to *C. iriana* n. sp. It differs in the colouration of the upperside, tricoloured antennae and a different shape of the lateral callus on the prothorax.

2.4 Genus *Ivalia* Jacoby, 1887

Ivalia ornata **n. sp.**
(Figs. 16, 31)

Holotype (♀): Borneo, Sabah, Crocker Range N. P., Rafflesia Centre, 13.–14.VI.1996, leg. J. Kodada (SMNS).

Etymology

The species name refers to the specific elytral pattern.

Description

Head and prothorax red fulvous; antennae piceous with basal segments and apical segment reddish fulvous; elytra fulvous with piceous margins (wider on anterior half of lateral margins), and oblique piceous band in anterior third, poorly delimited posteriorly (Fig. 16); all punctures on fulvous background look dark; underside and legs piceous, tibiae and tarsi more or less fulvous.

Body ovate, 1.4 times as long as wide. Head impunctate, shining, frontal tubercles indistinct, interantennal space very wide. Antennae reaching to the base of the elytra, proportions of segments 7-3-4-3-4-5-5-5-5-7, preapical segments 2.5 times as long as wide. Prothorax 2.35 times as wide as long, widest at base, lateral margins barely arcuate, with a distinct pore in anterior third, surface shining and nearly impunctate. Scutellum very small, triangular. Elytra 1.1 times as long as wide, strongly convex, with narrow apices, surface shining and impunctate, but with transparent dark and confused dots on fulvous background. Wings absent. Metasternum saddle-like elevated. First abdominal sternite with sharp ridge, widened anteriorly and almost reaching to the hind margin. Body length 2.3 mm.

Diagnosis

This is the first species of the genus *Ivalia* found on islands south of Thailand (Kimoto 2001). It clearly differs from all continental species in unusual elytral pattern (oblique dark band just behind the base, Fig. 16).

2.5 Genus *Sphaeroderma* Stephens, 1831

Sphaeroderma ovatomaculatum **n. sp.**
(Figs. 18, 32)

Holotype (♀): Indonesia, Bali, Danau Buyan, 1300 m, 19.–21.II.1994, leg. Bolm (SMNS).

Etymology

The species name refers to the shape of the elytral spot.

Description

Fulvous; 5 apical antennal segments and a rather large elongate ovate spot on each elytron black (Fig. 18).

Body ovate, 1.5 times as long as wide. Head impunctate, frontal tubercles transverse, delimited posteriorly by an almost straight impression. Antennae reaching to the anterior third of the elytra, proportions of segments 10-5-3-4-5-5-5-6-6-6-8, preapical segments about 1.5 times as long as wide. Prothorax 1.75 times as wide as long, lateral margins rounded, anterior angles not angulate, surface very finely and sparsely punctate. Scutellum triangular, with fine microsculpture. Elytra 1.05 times as long as wide, with fine dense punctures, arranged in 5 rather regular rows laterally. Segment 3 of anterior tarsi twice as wide as segment 1. Body length 2.8 mm.

Diagnosis

This new species is similar to *S. nigromaculatum* Jacoby, 1896 from Sumatra, which, however has the prothorax and the legs black. It differs from *S. bisbipunctatum* L. Medvedev, 2008, from Borneo in other elytral pattern and colouration of the antennae. In the key given in the revision of *Sphaeroderma* from the Oriental islands (Medvedev 2008) the new species might be placed just after item 27.

Sphaeroderma septempunctatum **n. sp.**
(Figs. 10, 17)

Holotype (♀): Borneo, Sabah, Mt. Kinabalu, 28.V.1999, leg. Z. Smrz (LM).

Etymology

The species name refers to the number of the elytral spots.

Description

Red fulvous; antennal segments 4–9 black, 1–3 and 10–11 fulvous; scutellum black; elytra with a large common pear-like sutural spot at base, humeral area, a transverse band (interrupted on suture) in the middle, and a smaller band on apical slope black (Fig. 17); breast, base of abdomen, apical half of tibiae and tarsi black.

Body ovate. Head impunctate, frontal tubercles transverse, delimited posteriorly by a straight impressed line. Antennae reaching to the humeral area of the elytra, proportions of segments 15-6-8-8-9-9-9-8-8-7-10, segments 5–10 slightly thickened, preapical segments about 1.5 times as long as wide. Prothorax 1.85 times as wide as long, lateral margins rounded, anterior angles obtusely angulate, with a pore, anterior margin barely concave, surface shining, impunctate. Scutellum triangular, impunctate. Elytra 1.15 times as long as wide, without distinct humeral tubercle, surface shining, finely and densely confusedly punctate. Segment 3 of anterior tarsi relatively narrow, about 1.5 times as wide as segment 1. Spermatheca see Fig. 10. Body length 4.2 mm.

Diagnosis

The new species is similar to *S. sabahense* L. Medvedev, 2008, but it is twice as large, with distinctly different elytral pattern, distinct frontal tubercles, fulvous vertex, and antennae (in part), underside and legs black.

2.6 Genus *Sutrea* Baly, 1876

This rather small genus consists of 33 species (and 7 newly described in this paper), distributed on islands of Southeast Asia, Australia and especially on New Guinea (19 species and 6 newly described in this paper). The original description of the genus is very short, many specific characters not being included (Baly 1876). As a result, *Sutrea* was placed near *Hemipyxis* Dejean, 1837 by Chen (1936) and Seeno & Wilcox (1982), but, indeed, *Sutrea* differs very sharply from both. Additional generic characters are added here: frontal tubercles cuneiform, touching each other and produced in part to a relatively narrow interantennal space; tarsal segment 3 practically not emarginate at apex (as in *Sphaeroderma*-like genera), or barely emarginated. The nearest relatives of *Sutrea* are probably *Chabria* Jacoby, 1887 and *Sphaeroderma*-like genera.

Sutrea antennata **n. sp.**
(Figs. 6, 23)

Holotype (♂): Borneo, Sabah, Crocker range, 1650 m, Gunung Emas, 4.VI.2003, leg. J. Šťastný (LM, received from J. Bezděk).

Etymology

The species name refers to the specific antennal colouration.

Description

Red fulvous; antennae with segments 1–4 fulvous (segment 4 darkened in part), 5–9 black, 10–11 pale fulvous; elytra black with ovate spot behind humerus and similar spot at apex fulvous (Fig. 23); tibiae and tarsi piceous to black.

Body elongate. Head impunctate, frontal tubercles cuneiform, not sharply divided from each other, interantennal space narrow, convex, but not ridged. Antennae almost reaching to the middle of the elytra, proportions of segments 9-5-7-9-9-8-8-8-8-8-10, preapical segments about 3 times as long as wide. Prothorax 2.5 times as wide as long, widest before the middle, barely arcuate laterally, angulate in anterior fifth, with a pore, hind margin with weak and wide basal lobe, surface shining and impunctate. Scutellum triangular, with minute punctures, apex rounded. Elytra 1.4 times as long as wide, less shining than prothorax, nearly impunctate. Segment 1 of fore and mid tarsi triangular, distinctly widened. Aedeagus see Fig. 6. Body length 7.0 mm.

Diagnosis

This new species is similar to *S. taeniata* Weise, 1917. It differs in its elytral pattern and the colouration of the legs (see couplet 19 in the key below).

Sutrea chevrolati (Guérin, 1830)

This species was insufficiently described. Weise (1908) proposed that *S. hexaspilota* Baly, 1876 is identical with *S. chevrolati* Guérin, because "both descriptions were based

on a single specimen from Dore". Furthermore, he assigned a specimen (with fulvous prothorax with black central stripe) to this species, using the name ab. *vitticollis* for it. This is strange because *S. hexaspilota* has an entirely fulvous prothorax, and *S. chevrolati* has a fulvous prothorax with a few smoky and poorly delimited small spots. Possibly *S. hexaspilota* and *S. chevrolati* are really identical, but ab. *vitticollis*, having a black central stripe, surely must belong to a different group of species, but this problem cannot be solved currently.

Neither the presumed synonymy nor the ab. *vitticollis* were included in the catalogue on Alticinae of HEIKERTINGER & CSIKI (1940), whereas other species described by WEISE on the same page of his paper have been considered.

Sutrea kolibaci **n. sp.**
(Figs. 19, 36)

Holotype (♀): New Guinea centr., Baliem Tal, 1700 m, III.1992, leg. J. KOLIBÁČ (SMNS).

Etymology

The name of this species is dedicated to its collector, Dr. JIŘÍ KOLIBÁČ (Brno).

Description

Head piceous with dark fulvous clypeus; antennae black with 3 basal segments piceous and apical segment fulvous; prothorax and scutellum piceous; elytra fulvous with transverse band just before the middle, another band behind the middle and apex piceous (Figs. 19, 36); underside and legs piceous.

Body elongate. Head impunctate, frontal tubercles triangular, poorly delimited posteriorly and divided from each other by an impressed line, interantennal space narrow, convex, but not ridged. Antennae reaching to the anterior third of the elytra, proportions of segments 10-4-6-9-9-9-8-8-8-10, preapical segments about 3 times as long as wide. Prothorax 1.7 times as wide as long, widest in the middle, slightly arcuate laterally, anterior angles thickened, with a pore, but not produced laterally, hind margin with very weak basal lobe, surface shining, very finely and sparsely punctate. Scutellum triangular, with minute punctures, apex rounded. Elytra 1.5 times as long as wide, less shining than prothorax, impunctate. Segment 1 of fore and mid tarsi triangular, distinctly widened. Body length 7.0 mm.

Diagnosis

The new species is similar to *S. triplagiata* Jacoby, 1904. It differs in the elytral pattern and the colouration of the legs (see couplet 5 in the key below).

Sutrea nigricornis **n. sp.**
(Figs. 5, 20–21, 38)

Holotype (♂): New Guinea, Irian Jaya, Anggi, Tetaho Iranmeba, 1500–1700 m, 25.III.1993, leg. A. RIEDEL (SMNS).

Paratypes: Same data as holotype, 2 ♀♀ (SMNS, LM). – New Guinea, Irian Jaya, Jayawijaya, Diuremna, 1900–2100 m, 9.–11.IX.1992, leg. A. RIEDEL, 1 ♀ (SMNS). – New Guinea, Irian Jaya, Jayawijaya, Nalca, 1900–2100 m, 8.IX.1992, leg. A. RIEDEL, 1 ♀ (LM).

Etymology

The species name refers to the black colour of the antennae.

Description

Black; prothorax pale flavous; elytra pale flavous with basal and preapical black bands (Figs. 20, 38); occasionally the black area is enlarged, i. e. the elytra appearing black with fulvous pattern (Fig. 21).

Body elongate ovate. Head impunctate, with round groove on vertex, frontal tubercles cuneiform, divided from each other with impressed line, poorly delimited posteriorly, interantennal space narrow and ridged. Antennae reaching the middle of the elytra, proportions of segments 7-3-6-6-7-7-7-7-7-7-8, preapical segments about 3.0–3.5 times as long as wide. Prothorax twice as wide as long, widest before the middle, lateral margins arcuate, anterior angles broadly rounded, with a pore, basal margin straight, surface shining and impunctate. Scutellum triangular with rounded apex, finely punctate. Elytra 1.35 times as long as wide, shining, very finely and sparsely punctate, without basal convexity and ridge near lateral margin before apex. Segment 1 of fore and mid tarsi practically not widened in ♂. Aedeagus (Fig. 5) moderately wide, strongly narrowed to apex, with a small tooth on each side in the apical third and a longitudinal impression in the apical third of the underside. Body length 4.8–5.5 mm.

Diagnosis

This new species clearly differs from all species with bicoloured elytra (except *S. quadripustulata* n. sp.) in having antennae and legs entirely black. From *S. quadripustulata* it differs in the long preapical antennal segments, the rounded anterior angles of the prothorax and the different elytral pattern (see couplet 12 in the key below).

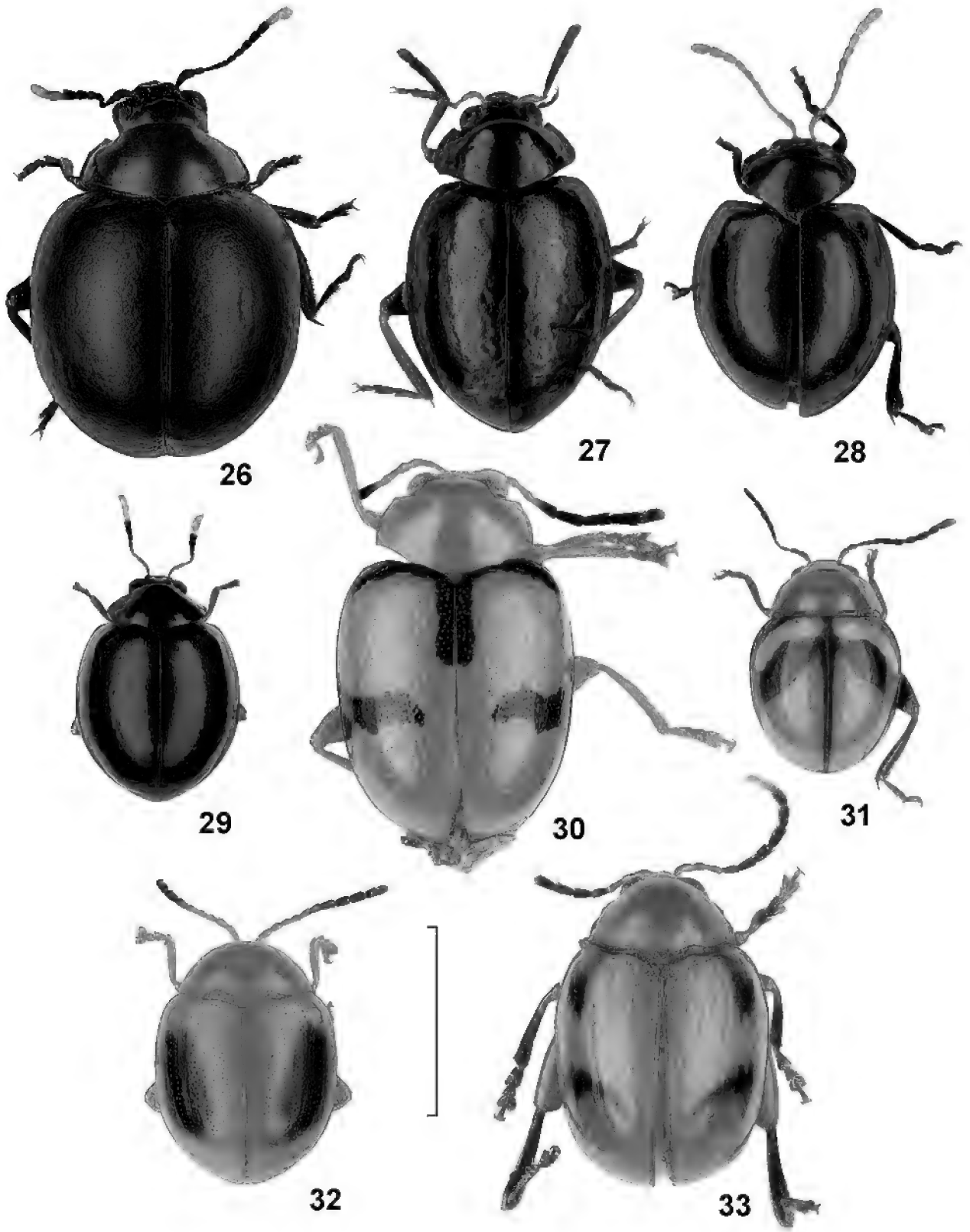
Sutrea nigripes **n. sp.**
(Fig. 39)

Holotype (♀): Papua New Guinea, Warigo, 9.XI.1965, leg. H. PYKA (SMNS).

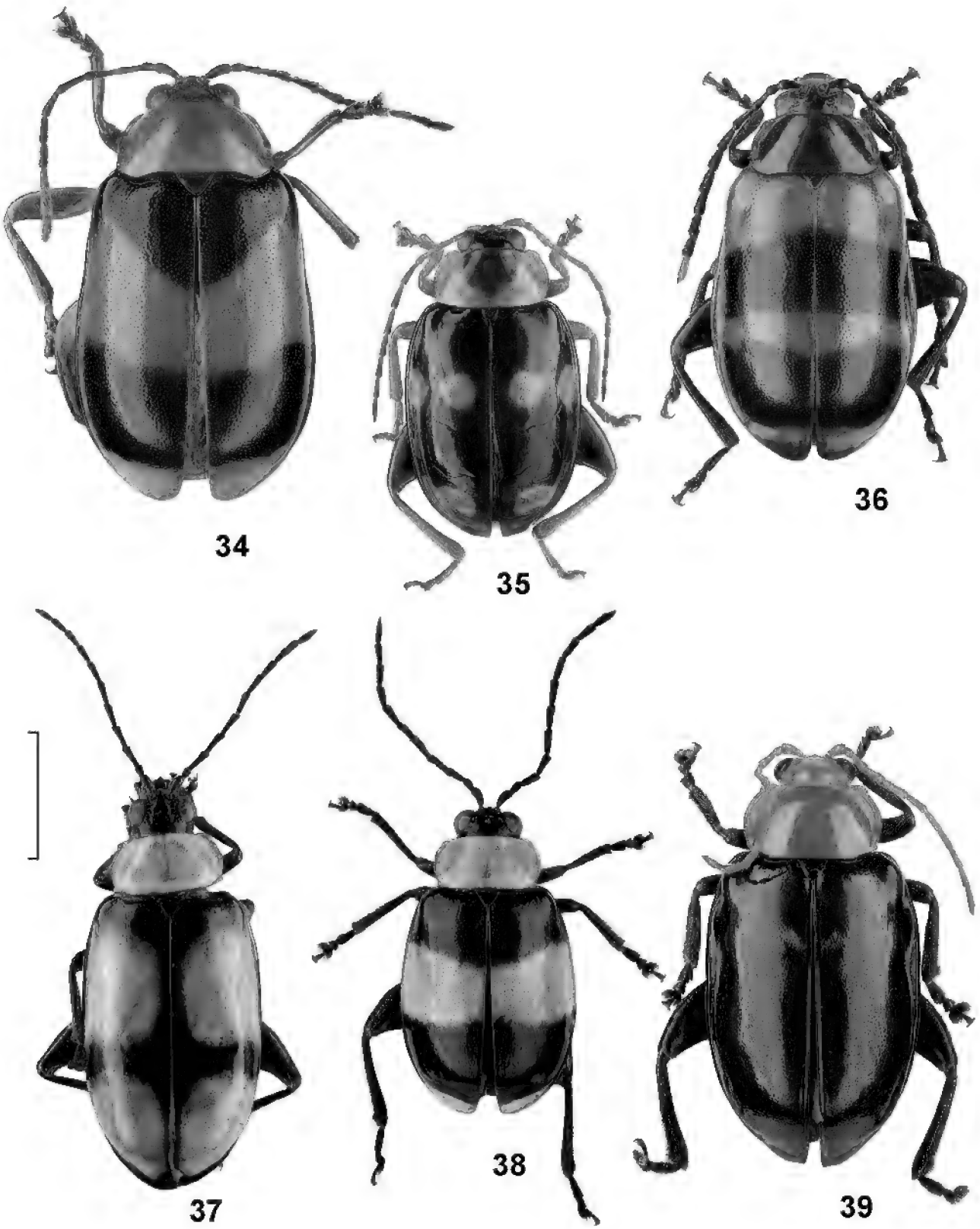
Paratype: New Guinea centr., Baliem Tal, 1700 m, III.1992, leg. J. KOLIBÁČ, 1 ♀ (LM).

Etymology

The species name refers to the black colour of the legs.



Figs. 26–33. Alticinae, holotypes. – **26**. *Chabria convexissima* n. sp. **27**. *C. papuana* n. sp. **28**. *C. iriana* n. sp. **29**. *C. riedeli* n. sp. **30**. *Acrocrypta doeberli* n. sp. **31**. *Ivalia ornata* n. sp. **32**. *Sphaeroderma ovatomaculatum* n. sp. **33**. *Neorthella rufofulva* n. sp. – Scale: 2 mm.



Figs. 34–39. *Sutrea* spp., holotypes. – **34**. *S. riedeli* n. sp. **35**. *S. weigeli* n. sp. **36**. *S. kolibaci* n. sp. **37**. *S. quadripustulata* n. sp. **38**. *S. nigricornis* n. sp. **39**. *S. nigripes* n. sp. – Scale: 2 mm.

Description

Fulvous; scutellum and elytra metallic green; metasternum, abdomen and legs black.

Body elongate ovate. Head impunctate (except a few punctures near eyes), frontal tubercles cuneiform, divided by a deep impressed line, interantennal space narrow, ridge-like. Antennae reaching to the middle of the elytra, proportions of segments 8-4-7-8-9-9-9-8-7-7-10, preapical segments about twice as long as wide. Prothorax 1.7 times as wide as long, widest before the middle, lateral margins slightly arcuate, anterior angles distinct, produced, with a pore, basal margin straight, surface shining, impunctate. Scutellum triangular, with minute punctures, apex rounded. Elytra 1.4 times as long as wide, shining, indistinctly punctate, with a high basal convexity and a weak longitudinal elevation before the apical slope near to the lateral margin. Body length 6.5–6.8 mm.

Diagnosis

The new species is very similar to *S. violaceipennis* Jacoby, 1885 and *S. punctipennis* Weise, 1908. It differs from both in the colouration of elytra and legs and the high basal elevation of the elytra (see couplets 2 and 3 in the key below).

Sutrea quadripustulata **n. sp.**
(Figs. 22, 37)

Holotype (♀): New Guinea, Irian Jaya, Wamena E, Habbema lake, Pendok Yabogaima, 3200 m, 4°7'S 138°43'E, 21.I.1999, leg. A. Weigel (NMEG).

Paratype: New Guinea, Irian Jaya, Wamena W, Tailarek, 4°3'S 138°44'E, 2300 m, 22.I.1999, leg. A. Weigel, 1 ♀ (LM).

Etymology

The species name refers to the four spots on the elytra.

Description

Black; prothorax pale flavous; each elytron with 2 very large fulvous spots, its lateral margin very narrowly black (Figs. 22, 37).

Body elongate ovate. Head impunctate, vertex with a longitudinal impression, frontal tubercles cuneiform, divided from each other by a shallow impression, poorly delimited posteriorly, interantennal space narrow and ridged. Antennae reaching to the middle of the elytra, proportions of segments 7-3-7-6-6-6-6-6-5-5-7, preapical segments about twice as long as wide. Prothorax twice as wide as long, widest in the middle, lateral margins arcuate, anterior angles distinct, slightly produced, with a pore, basal margin straight, surface shining and impunctate. Scutellum triangular with rounded apex, impunctate. Elytra 1.6 times as long as wide, shining, very finely punctate, without basal convexity, with a weak longitudinal elevation along lateral margin from humerus to apical slope. Body length 5.8–7.0 mm.

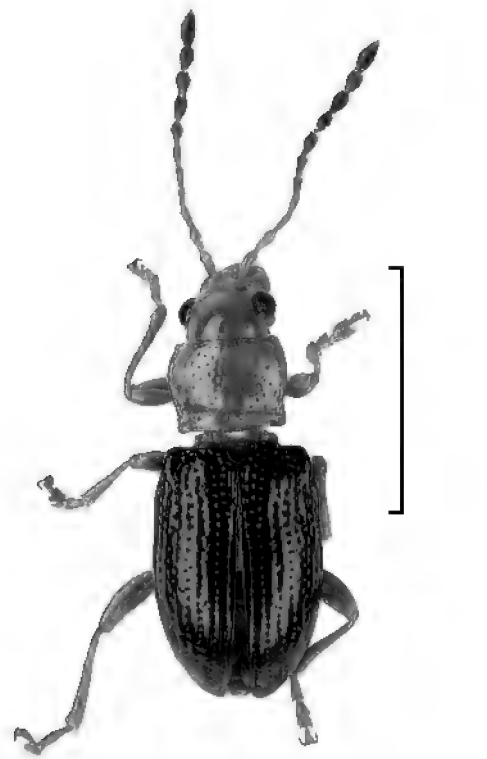


Fig. 40. *Orthaltica riedeli* n. sp., holotype. – Scale: 1 mm.

Diagnosis

This new species is similar to *S. nigricornis* n. sp. It differs in its completely different elytral pattern, the short preapical antennal segments, and the distinct and moderately produced anterior angles of the prothorax (see also couplet 12 in the key below).

Sutrea riedeli **n. sp.**
(Figs. 11, 25, 34)

Holotype (♀): Maluku, Island Halmahera Ibu, Desa Nanas, Gunung Gamkonora, 100–1000 m, 27.XI.1999, leg. A. Riedel (SMNS).

Etymology

The name of this species is dedicated to its collector, Dr. Alexander Riedel (Karlsruhe).

Description

Fulvous; antennae black with segments 1–3 dark fulvous and 9–11 fulvous; elytra with a basal band (triangularly widened towards suture) and a wide preapical band piceous (Figs. 25, 34); metasternum piceous laterally.

Body elongate. Head impunctate, frontal tubercles cuneiform, poorly delimited posteriorly and delimited in part from each other by an impressed line, interantennal space flat. Antennae reaching to the middle of the elytra, proportions of segments 9-5-9-11-10-10-9-8-8-7-8, preapical segments about 2.5 times as long as wide. Prothorax twice as wide as long, widest before base, almost straight laterally, anterior angles thickened, with a pore, not produced angularly, basal margin straight, surface shining, with very fine and sparse, almost indistinct punctures. Scutellum triangular with rounded apex, impunctate. Elytra 1.4 times as long as wide, densely and distinctly punctate (except on apical slopes, where the punctures are strongly diminished). Spermatheca see Fig. 11. Body length 7.0 mm.

Diagnosis

This is the first species of the genus *Sutrea* described from Halmahera island. Only *S. taeniata* Weise, 1917 from New Guinea and *S. antennata* n. sp. from Borneo are similar. The new species differs from both in the fulvous legs and antennal segments 9–11, and in the different elytral pattern.

Sutrea weigeli **n. sp.**
(Figs. 7, 24, 35)

Holotype (♂): New Guinea, Irian Jaya, Asori, 60 km E Kwadewa, Camp near Wapoga River, 2°49'S 136°28'E, 10.I.1999, leg. A. WEIGEL (NMEG).

Paratype: New Guinea, Irian Jaya, Nabire, 70 km W Yamorlake, Gariau, 3°43'S 134°56'E, 1.III.1998, leg. A. WEIGEL, 1 ♂ (LM).

Etymology

The name of this species is dedicated to its collector, ANDREAS WEIGEL (Wernburg).

Description

Black; antennae fulvous with slightly darkened apical segments; prothorax pale fulvous with a central black stripe which is strongly narrowed in the basal part; elytra with two round spots in a transverse row before the middle and an ovate spot on apical slope pale fulvous (Figs. 24, 35); legs fulvous with black hind femora.

Body elongate ovate. Head impunctate, frontal tubercles cuneiform, divided by a deep impression, interantennal space convex, not ridged. Antennae reaching to the middle of the elytra, proportions of segments 8-4-7-6-7-8-8-7-7-7-8, preapical segments about 4 times as long as wide. Prothorax 1.9 times as wide as long, widest in the middle, lateral margins arcuate, anterior angles distinct, thickened, with a pore, basal margin slightly arcuate, without basal lobe, surface shining, impunctate. Scutellum short triangular with rounded apex, impunctate. Elytra 1.25 times as long as wide, shining, very finely punctate, without basal convexity and lateral ridge on apical slope. Segment 1 of fore and mid tarsi moderately widened. Aedeagus (Fig. 7) very thin, about 10 times as long as wide. Body length 5.0–5.5 mm.

Diagnosis

This new species is similar to *S. collaris* Jacoby, 1885. It differs in its elytral pattern, the colouration of the legs and its smaller size (see couplet 25 in the key below).

Key to the New Guinean species of *Sutrea*

1 Elytra metallic green, blue or violaceous blue, head, antennae and prothorax fulvous (Fig. 39). **2**
– Upperside without metallic colour (Figs. 35–38). **4**
2 Legs black (Fig. 39). Elytra metallic green, indistinctly punctate, with traces of elevation on apical slope. Anterior angles of prothorax produced. – Body length 6.5 mm. ..... ***S. nigripes* n. sp.**
– Legs more or less fulvous. Elytra metallic blue or violaceous. Anterior angles of prothorax rounded. **3**
3 Legs fulvous, only hind femora black. Elytra usually with a sharp longitudinal ridge on apical slope near lateral margin, delimited by impressions. Body length 5.7–6.3 mm. ..... ***S. violaceipennis*** Jacoby, 1885
– Legs fulvous with black hind femora and blackish tarsi and apices of tibiae. Elytra with weak longitudinal elevation on apical slope, punctation stronger. Body length 4.6–4.8 mm. – Spermatheca see Fig. 12. ..... ***S. punctipennis*** Weise, 1908
4 Prothorax black or piceous (Fig. 36). – Antennae black with fulvous apical segment. Head, legs and underside black or piceous. **5**
– Prothorax fulvous (Figs. 37, 38), occasionally with black central stripe (Fig. 35). **6**
5 Elytra fulvous with a transverse band at base, an elongate spot below middle, the apex and posterior portion of suture black. Body length 5.0–7.0 mm. ..... ***S. triplagiata*** Jacoby, 1904
– Elytra fulvous with a band just before the middle, another band behind the middle and the apex piceous (Figs. 19, 36). Body length 6.0 mm. ..... ***S. kolibaci* n. sp.**
6 Prothorax entirely fulvous (Figs. 37, 38). **7**
– Prothorax fulvous with a black central stripe (Fig. 35) or a few darkened poorly delimited spots. **22**
7 Elytra entirely black or with the anterior third fulvous, or with lateral margin less dark. – Head and antennae fulvous, apical antennal segments slightly darkened, breast fulvous. **8**
– Elytra fulvous with black pattern or black with fulvous spots and/or bands. **11**
8 Elytra finely rugose or wrinkled, of leathery appearance, impunctate, more or less fulvous laterally. – Legs fulvous with piceous hind femora, abdomen piceous. Body length 3.5–4.0 mm. ..... ***S. semirugosa*** Jacoby, 1904
– Elytra not wrinkled, shining. **9**
9 Lateral margin of elytra wide and reflexed; there is a weak elevation from humerus to apex. – Legs fulvous with black hind femora, abdomen black. Elytra very minutely punctate. Body length 4.0 mm. Aedeagus see Fig. 8, spermatheca see Fig. 13. ..... ***S. marginipennis*** Jacoby, 1904.

– Elytra with narrow, not reflexed lateral margin and without lateral elevation. **10**

10 Elytra black with fulvous anterior third or entirely black, finely punctate. Legs fulvous with black apices of hind femora. Abdomen fulvous. Body length 5.8 mm. ..... ***S. dimidiatipennis*** Jacoby, 1885

– Elytra entirely black, impunctate. Legs entirely fulvous. Abdomen fulvous, piceous laterally. Body length 4.0 mm. ..... ***S. laevipennis*** Jacoby, 1904

11 Head, antennae and legs entirely black (Figs. 37, 38)..... **12**

– Antennae and legs entirely or in part fulvous. **13**

12 Elytra fulvous with wide basal and postmedian bands black (Figs. 20, 38), the black colour often enlarged so that the elytra appear as black with fulvous pattern (Fig. 21). Preapical antennal segments 3.0–3.5 times as long as wide. Anterior angles of prothorax rounded. Body length 4.8–5.5 mm. – Aedeagus see Fig. 5. ..... ***S. nigricornis*** **n. sp.**

– Elytra black with two very large fulvous spots (Fig. 22, 37). Preapical antennal segments twice as long as wide. Anterior angles of prothorax distinct and produced. Body length 5.8–7.0 mm..... ***S. quadripustulata*** **n. sp.**

13 Elytra fulvous with basal band and large spot behind, middle area black. – Legs fulvous with apices of hind femora black, underside fulvous with black prosternum. Head and antennae pale flavous, only the 4 apical antennal segments reddish piceous. Antennae reaching only a little behind the humerus. Body length 4.0 mm..... ***S. brevicornis*** Weise, 1917

– Elytra black with fulvous spots and/or bands..... **14**

14 Head black. **15**

– Head fulvous. **18**

15 Antennae black with 4 basal segments fulvous. – Elytra with pre- and postmedian bands and apices fulvous. Legs fulvous with black hind femora, underside dark brown. Body length 4.2–5.2 mm. ..... ***S. albofasciata*** Baly, 1876

– Antennae fulvous or with apical segments a little darker. **16**

16 Elytra with a narrow transverse band in the middle and a small round spot at the apex. Fore and mid legs fulvous, hind legs and underside black. – Body length 5.2 mm. ..... ***S. balyi*** Jacoby, 1885

– Elytra with two round spots before the middle and a transverse band behind the middle fulvous. Legs fulvous with piceous or black hind femora. **17**

17 Underside black. Median lobe of the last abdominal sternite of the ♂ with a long triangular and deep excavation over the entire length of that segment. Body length 4.7 mm..... ***S. sexmaculata*** Jacoby, 1894

– Underside fulvous. Median lobe of the last abdominal sternite of the ♂ without a deep excavation. Body length 5.2–5.3 mm. [see below under *S. chevrolati*]..... ***S. hexaspilota*** Baly, 1876

18 Antennae fulvous with the segments 5–9 black. – Elytra with an oblique band from humerus to middle of suture. Legs fulvous with apices of hind femora black, underside fulvous. Body length 6.3–7.5 mm. ..... ***S. taeniata*** Weise, 1917

– Antennae fulvous, at most with darkened apical segments. .. **19**

19 Elytra with a single transverse fulvous spot before the middle (sometimes touching the suture and appearing as a transverse band). – Legs fulvous with piceous hind femora, underside piceous. Body length 4.2–5.2 mm. ..... ***S. bipustulata*** Baly, 1876

– Elytra with a more differentiated pattern. **20**

20 Body length 7.4–8.4 mm. – Elytra with pre- and postmedian bands and fulvous apices. Legs fulvous with black apices of hind femora, underside fulvous. ..... ***S. elegans*** Baly, 1876

– Body length at most 6 mm. **21**

21 Elytra with fulvous pre- and postmedian bands. Legs dark fulvous, underside piceous. Body length 3.5–4.2 mm. ..... ***S. wallacei*** Baly, 1876

– Elytra with a large and wide spot in the middle, apices fulvous. Legs fulvous with black hind femora (except basally), underside fulvous. Body length 5–6 mm..... ***S. flavofasciata*** Jacoby, 1898

22 Prothorax with a few smoky and poorly delimited spots. Head and elytra black, the latter with two round spots in a transverse row in the middle and a reniform spot before the apex fulvous. Antennae, underside and legs fulvous, hind femora darkened. – Body length 5.0 mm. [Possibly identical with *S. hexaspilota* Baly, 1876]. ..... ***S. chevrolati*** Guérin, 1830

– Prothorax with a black central stripe which is strongly narrowed in the basal part. Antennae fulvous, at most with darkened apical segments. Elytra black with fulvous spots or bands..... **23**

23 Vertex and labrum black, clypeus and frontal tubercles pale flavous. – Elytra with a narrow transverse band in the middle and a round spot before the apex fulvous. Legs fulvous with black hind femora. Body length 4.2–5.3 mm..... ***S. impressa*** Jacoby, 1894

– Head entirely black. **24**

24 Elytra with a narrow transverse band in the middle and a round spot before the apex fulvous. Fore and middle legs fulvous, hind legs black. Body length 5.8–6.3 mm. ..... ***S. collaris*** Jacoby, 1885

– Elytra with two round spots in a transverse row in the middle and a transverse spot before the apex fulvous (Figs. 24, 35). Legs fulvous with black hind femora. Body length 5.0–5.5 mm. – Aedeagus very narrow (Fig. 7).... ***S. weigeli*** **n. sp.**

2.7 Genus *Orthaltica* Crotch, 1873

Orthaltica riedeli **n. sp.**
(Fig. 40)

Holotype (♂): New Guinea, Irian Jaya, Jayawijaya, Bommeba, 30.VIII.–1.IX.1992, ca. 1750 m, leg. A. Riedel (SMNS).

Paratype: New Guinea, Irian Jaya, Anggi, Tetaho Iranmeba, 1500–1700 m, 25.III.1993, leg. A. Riedel, 1 ♀ (LM).

Etymology

The name of this species is dedicated to its collector, Dr. Alexander Riedel (Karlsruhe).

Description

Fulvous; head and prothorax reddish fulvous; 5 apical antennal segments piceous to black; elytra and underside black.

Head impunctate (except 6 setiferous punctures), shining, without impressions, frontal sutures forming an angle of about 80–90°, interantennal space narrow, with sharp ridge. Antennal tubercles absent, eyes big and convex, vertex with two rows of setiferous punctures, anterior row

with 2 punctures, posterior one with 4 punctures. Antennae almost reaching to the middle of the elytra, the 5 apical segments thickened, proportions of segments 10-8-6-6-6-6-6-6-6-10, preapical segments about 1.5 times as long as wide. Prothorax 1.5 times as wide as long, cordiform, not serrate laterally and without any teeth, anterior angles oblique, ending with a setiferous pore, basal transverse impression deep and punctate, disk with strong and moderately dense punctures. Elytra 1.5 times as long as wide, with distinct humeral tubercle and very weak basal convexity, covered with erect sparse hairs, rows of punctures distinct towards apex, interspaces narrow, flat and shining. Body length of ♂ 1.7 mm, of ♀ 1.8 mm.

Diagnosis

This is the first species of *Orthaltica* found in New Guinea. It is near *O. laticollis* (Scherer, 1971), but much larger, with head and prothorax reddish fulvous, and its body elongate.

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Annotated host catalogue for the Tachinidae (Diptera) of Italy

Pierfilippo Cerretti & Hans-Peter Tschorsnig

Abstract

An annotated host catalogue is given for the Tachinidae of Italy. It comprises 180 tachinid species reared from 310 arthropod hosts belonging to seven insect orders and one chilopod order. The paper includes data from literature as well as hitherto unpublished records.

Key words: Tachinidae, parasitoids, host catalogue, Italy.

Zusammenfassung

Für die italienischen Tachinidae wird ein kritischer Wirtekatalog gegeben. Er umfasst 180 Tachiniden-Arten und 310 Arthropoden-Wirtsarten aus sieben Insektenordnungen und einer Ordnung der Hundertfüßer. Die Arbeit enthält sowohl Daten aus der Literatur als auch bisher unveröffentlichte Wirtsangaben.

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1 Introduction

Tachinidae (Diptera) are an important group of parasitoids of insect pests in agriculture and forestry. Many applied entomologists have reared Tachinidae in Italy during the last decades, but there was a noticeable lack of a modern critical overview of the host records. The present paper fills this gap.

Earlier host-parasitoid catalogues covering Italian Tachinidae were written by Rondani (1872–1878), Cecconi (1924), Leonardi (1922–1928), and Boselli (1928). All are absolutely out of date. Rondani's (1872a, 1873, 1877, 1878) catalogue, not restricted to Italy, was mainly compiled from the literature – without references. Only the records marked by Rondani as "obs. n." or considered probably to be original records are included in the present paper. Leonardi's (1922–1928) catalogue was compiled from the old literature (mainly from Rondani 1872–1878), and also the continuation of this catalogue by Boselli (1928) was based on literature references only (mostly from Cecconi 1924). The data on reared Tachinidae in Cecconi's (1924) textbook on forest entomology were mainly compiled from the literature, but a few were original rearing records by this author from Italy and are included in the present catalogue.

The authors of the present catalogue give all original records that they found in the literature, but there is no guarantee that this list is complete because records are scattered in many papers and sometimes only appear as marginal footnotes. This catalogue also includes a number of new records, identified by the authors during recent years. From 2005 to 2009, the first author visited several Italian collections (DEZA, FVCP, IEGG, MFNB, MSNG, MSNV, MZUF, and MZUR) to check for reared Tachinidae.

Some host records are based on several old notes of B. Herting († 2004). The handwritten notes of Herting, as cited in the present paper, are mainly side notes in a copy of his proof of Herting (1960). "Bologna" or "Mellini" in these notes probably refers to material that was sent to Herting by Mellini for identification from the 1960s to the early 1970s. B. Herting also left several notes on older records of Tachinidae, which the authors found helpful in interpreting some critical cases.

Data on reared Tachinidae identified for the IOBC (International Organization for Biological and Integrated Control of Noxious Animals and Plants) were published in the IOBC-lists 5–14 (see references). The identifications for those lists were made by Mesnil (lists 5, 6), Herting (lists 8–10), Herting & Tschorsnig (lists 11, 12), Tschorsnig & Herting (list 13), and Tschorsnig (list 14). Records from the IOBC-lists are (normally) not replicated here if the information was independently published by the breeder of the respective material.

Records of tachinid rearings on artificial substrates are not included in this paper.

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2 Explanation of the format

Parasitoid-host list

The arrangement of the tachinids follows the relevant and widely used systematic catalogue of Herting & Dely-Draskovits (1993). The tachinid genera and species are given in their actual valid nomenclature; probable misidentifications are – if possible – tentatively corrected. Synonyms, different combinations, emendations, misspellings or misidentifications from the cited papers, as well as all other explanatory notes, are given in square brackets. Records that are probably wrong and that cannot be corrected or very atypical records are set in square brackets. Some notes on certain problematic records are also given at the end of the parasitoid-host list.

Host orders, families, genera and species are alphabetically arranged, their nomenclature follows Fauna Europaea (http://www.faunaeur.org/). Author and year of the hosts can be found in full in the host-parasitoid list.

The literature records are listed in chronological order for each parasitoid-host couple.

Host-parasitoid list

Host orders, families, genera and species are alphabetically arranged. Synonyms or aberrant spellings which were used in the cited papers are given in square brackets.

The tachinids are arranged in order of their importance for the host, the most important or specific parasitoids are mentioned first, doubtful or very uncommon hosts are set in square brackets. Author and year of the tachinids can be found in full in the parasitoid-host list.

Abbreviations

CE	Pierfilippo Cerretti
coll.	collection
corr.	correction, corrected
e. l.	ex larva
em.	emerged
e. p.	ex pupa
gen.	genus
HE	Benno Herting
misid.	misidentified, misidentification(s)
prb.	probably
s.	see
s. a.	see also (means another paper with additional data, but referring to the same rearing)
sp.	species
TS	Hans-Peter Tschorsnig
rev.	revised, revision

Acronyms of depositories

CEAP	Collezione Entomologia Agraria, Università di Pisa, Italy
CEC	Collection E. Cargnus, Udine, Italy
CGG	Collection G. Governatori, Pordenone, Italy
CPC	Collection P. Cerretti, Verona, Italy
CRP	Collection R. Pantaleoni, Sassari, Italy
DEZA	Dipartimento di Entomologia e Zoologia Agraria dell'Università di Napoli, Portici, Italy
FVCP	Collection Filippo Venturi, Università di Pisa, Italy
IEGG	Dipartimento di Scienze e Tecnologie Agroambientali [formerly: Istituto di Entomologia "Guido Grandi"], Università di Bologna, Italy
MFNB	Museo Friulano di Storia Naturale, Udine, Italy
MSNG	Museo Civico di Storia Naturale "Giacomo Doria", Genova, Italy
MSNV	Museo Civico di Storia Naturale, Verona, Italy
MZUF	Museo Zoologico "La Specola", Firenze, Italy
MZUR	Museo di Zoologia, Sapenza Università di Roma, Rome, Italy
NHMW	Naturhistorisches Museum, Vienna, Austria
SMFD	Forschungsinstitut und Naturmuseum Senckenberg, Frankfurt am Main, Germany
SMNS	Staatliches Museum für Naturkunde, Stuttgart, Germany

3 Annotated parasitoid-host list

Exorista civilis (Rondani, 1859)

Lycia florentina (Geometridae): Herting 1975

Exorista deligata Pandellé, 1896

[***Aglais urticae*** (Nymphalidae): New record: 1 ♂, Campania, Benevento, 15.VI.1918, det. CE (DEZA)] [*E. deligata* is a specific parasitoid of Psychidae; it is more likely that some psychid host was hidden among the host plant material; *A. urticae* is very commonly reared, with its parasitoids well-known]
Psychidae gen. sp.: Cerretti 2001a

Exorista fasciata (Fallén, 1820) [records in square brackets possibly refer to *E. segregata* or *E. larvarum*, but this must be confirmed]

[***Malacosoma neustria*** (Lasiocampidae): Martelli & Arru 1958; Prota 1974]
Euproctis chrysorrhoea (Lymantriidae): New records: 1 ♂, Calabria, Cosenza prov., San Giovanni in Fiore, 6.VII.1941, det. CE (DEZA); 2 ♂♂, [without locality], 1.VIII.1953, leg. G. Della Beffa, det. CE (MSNV)
[***Lacanobia oleracea*** (Noctuidae): Castellari 1969]
[***Mamestra brassicae*** (Noctuidae): Castellari 1969]

Exorista grandis (Zetterstedt, 1844)

Hyles hippophaes (Sphingidae): handwritten note of HE ("Bologna")

Exorista larvarum (Linnaeus, 1758) [*Tachina*, *Eutachina*; Liotta's *Larvaevora larvarum* is prb. misid.; it is likely that – in the combination with *Tachina* – "*noctuarum* Rondani" was meant by Del Guercio 1900c, not "*noctuarum* Desv." as written by him]

[***Lixomorphus algirus*** (Curculionidae): Liotta 1963]
Hyphantria cunea (Arctiidae): Allegro 1987; Tiberi & Bin 1987 (s. a. Bin et al. 1994); Nanni et al. 1989 (s. a. Nanni 1991); IOBC-List 12; IOBC-List 13; Camerini & Groppali 1999; Dindo et al. 2006 (s. a. Marchetti 2006)
Phragmatobia fuliginosa (Arctiidae): Sannino et al. 2001 (s. a. IOBC-List 12); handwritten note of HE ("Mellini, Bonifica Renana")
Spilosoma luteum (Arctiidae): Mellini 1963
Arctiidae gen. sp.: New record: 1 ♀, Friuli-Venezia Giulia, Udine prov., Campoformido, near Basaldella, 80 m, host collected 4.VII.1999, em. 22.VII.1999, leg. C. Morandini, det. CE (MFNB)
Lycia florentina (Geometridae): handwritten note of HE ("Mellini, Crespellano")
Gastropacha quercifolia (Lasiocampidae): Prota 1974; Luciano & Roversi 2001
Malacosoma neustria (Lasiocampidae): Cecconi 1924; Delrio et al. 1983; Luciano & Roversi 2001
Calliteara pudibunda (Lymantriidae): Prota 1974; IOBC-List 13
Euproctis chrysorrhoea (Lymantriidae): Prota 1974; Currado et al. 1988 (s. a. IOBC-List 11)
Leucoma salicis (Lymantriidae): Cecconi 1924; handwritten note of HE ("Bologna"); New record: 6 ♂♂, 6 ♀♀, Piemonte, Torino prov., Torrente Stura, VI.1925, leg. G. Della Beffa, det. CE (MSNV)
Lymantria dispar (Lymantriidae): Howard 1906; Cecconi 1924; Burgess & Crossman 1929; IOBC-List 8; Prota 1974; Delrio et al. 1979 (s. a. Luciano & Prota 1982a, Luciano & Prota 1982b, Luciano et al. 1982); Luciano & Prota 1986; IOBC-List 13; Dindo et al. 1999 [laboratory]; Luciano & Roversi 2001; Dindo et al. 2002; IOBC-List 14
Lymantria monacha (Lymantriidae): Hellrigl 1997 (s. a. Hellrigl 2004)
Orgyia antiqua (Lymantriidae): IOBC-List 11; handwritten note of HE ("Mellini")
Acronicta rumicis (Noctuidae): Prota 1974
Acronicta sp. [cf. ***rumicis***] (Noctuidae): New record: 1 ♂, Campania, Salerno prov., Scafati, 9.IV.1916, det. CE (DEZA)
Agrotis ipsilon (Noctuidae): Menozzi 1947; handwritten note of HE ("Mellini, Budrio") [1 ♂ in SMNS]
Agrotis segetum (Noctuidae): Menozzi 1938 (s. a. Menozzi 1947); Prota 1974
Autographa gamma (Noctuidae): Prota 1974
Axylia putris (Noctuidae): Sannino et al. 2001 (s. a. IOBC-List 12)
Helicoverpa armigera (Noctuidae): Del Guercio 1900c
Lacanobia oleracea (Noctuidae): Sannino et al. 1993; IOBC-List 13
Mamestra brassicae (Noctuidae): Bongiovanni 1958; Prota 1974; Sannino & Espinosa 1998 (s. a. Sannino & Espinosa 1999); handwritten note of HE ("Bologna")
Mythimna unipuncta (Noctuidae): IOBC-List 11; handwritten note of HE ("Mellini, Maccarese") [3 ♂♂, 11. and 20.IX.1971, in SMNS; 1 ♂ IEGG]; New record: 12 ♂♂, 3 ♀♀, Friuli-Venezia-Giulia, Pordenone prov., San Quirino, 110 m, em. 20.IX.–18.X.2007, leg. G. Governatori, det. CE (CGG)
Ochropleura leucogaster (Noctuidae): Sannino et al. 2001 (s. a. IOBC-List 12)
Phalera bucephala (Notodontidae): handwritten note of HE ("Mellini, Borgo Capanne")
Melitaea didyma (Nymphalidae): New record: 1 ♀, Viareggio, Toscana, Lucca prov., 2 km N, 22.VI.1960, leg. F. Heller, det. TS (SMNS)
Nymphalis antiopa (Nymphalidae): Cecconi 1924
Phalacropterix apiformis (Psychidae): IOBC-List 9
Galleria mellonella (Pyralidae): Mellini & Campadelli 1997; Mellini & Campadelli 1998; Dindo et al. 1999; Dindo et al. 2002; Dindo et al. 2006; Marchetti 2006 [all laboratory]
Saturnia pyri (Saturniidae): Prota 1974
Hyles euphorbiae (Sphingidae): IOBC-List 11
Macroglossum stellatarum (Sphingidae): Prota 1974

Exorista mimula (Meigen, 1824) [*verax* Robineau-Desvoidy; misid. as *Eutachina rustica* by Menozzi 1947, rev. HE, CE]

Athalia rosae (Tenthredinidae): Menozzi 1947 (s. a. Herting 1967)

Exorista nova (Rondani, 1859)

Zygaena erythrus (Zygaenidae): IOBC-List 9

Exorista segregata (Rondani, 1859) [*Tricholyga*; prb. misid. as *Parasetigena segregata* by Martelli 1903, 1907 and *Tricholyga grandis* by Cecconi 1924]	***Lymantria dispar*** (Lymantriidae): Cecconi 1924; Prota 1974; Delrio et al. 1979 (s. a. Luciano & Prota 1982a, Luciano et al. 1982); Luciano & Prota 1986 ***Sesamia nonagrioides*** (Noctuidae): IOBC-List 8 ***Aporia crataegi*** (Pieridae): Martelli 1931; Herting 1960; New record: 1 ♂, 3 ♀♀, Puglia, Foggia, V.1929, det. CE (DEZA) ***Pieris brassicae*** (Pieridae): Martelli 1903 (s. a. Martelli 1907) ***Thaumetopoea processionea*** (Thaumetopoeidae): Cecconi 1924 [not yet confirmed by other rearings of this host] ***Traumatocampa pityocampa*** (Thaumetopoeidae): Cecconi 1924 ***Zygaena orana*** (Zygaenidae): IOBC-List 11
Exorista sorbillans (Wiedemann, 1830)	***Smerinthus ocellatus*** (Sphingidae): IOBC-List 11; Farneti et al. 1998; IOBC-List 14 **Sphingidae** gen. sp.: New records: 1 ♂, Emilia-Romagna, Bologna, X.1980, leg. De Giovanni, det. TS (SMNS); 1 ♂, Emilia-Romagna, Bologna prov., Sasso Marconi, 4.XI.1996, leg. R. Farneti, det. TS (SMNS)
Exorista xanthaspis (Wiedemann, 1830) [misid. as *Tachina larvarum* by Faggioli 1931, rev. HE]	***Brithys crini*** (Noctuidae): Faggioli 1931; IOBC-List 9; New record: 1 ♂ (e. p.), Lazio, Roma prov., Focene, X.2001, leg. A. Zilli, det. CE (CPC)
Exorista sp.	***Theresimima ampellophaga*** (Zygaenidae): Pucci & Dominici 1986 [Tachinidae lost, pers. comm. C. Pucci]
Neophryxe vallina (Rondani, 1861)	***Meganola togatulalis*** (Nolidae): New record: 1 ♂, Emilia-Romagna, Piacenza, 23.VI.1986, det. HE, TS (SMNS) **Pyralidae** gen. sp.: Robertson & Shaw in prep.
Chetogena filipalpis Rondani, 1859 [*Chaetogena*, *Spoggosia*]	***Nycteola revayana*** (Nolidae): New record: 1 ♂, Trentino-Alto Adige, Bolzano prov., Terlano (= Terlan), 5.VI.1921, coll. Engel, det. TS (SMNS) ***Apterona crenulella*** (Psychidae): Mellini 1987 ***Canephora hirsuta*** (Psychidae): Herting 1960 [Val Venosta, leg. C. Hartig, 2 ♀♀ in NHMW, teste TS]; New record: 2 ♂♂, 3 ♀♀, Trentino-Alto Adige, Bolzano prov., Val Venosta, Staben, 800 m, 25.V.1934, leg. Hartig, det. CE (MZUR) ***Phalacropterix apiformis*** (Psychidae): New record: 1 ♂, Lazio, Monte Pellecchia, em. 8.IV.1949, leg. Hartig, det. CE (MZUR) ***Psyche crassiorella*** (Psychidae): Herting 1960 [Trentino-Alto Adige, Terlano, 1 ♀, coll. Engel, SMNS] **Psychidae** gen. (prb. ***Psyche***) sp.: New record: 1 ♂, Veneto, Lago di Garda, San Vigilio, 15.–20.IV.1941, leg. Hartig, det. TS (MZUR)
Chetogena obliquata (Fallén, 1810) [*Phorocera gramma* Meigen]	***Lasiocampa trifolii*** (Lasiocampidae): Rondani 1877 (s. a. Rondani 1878)
Diplostichus janitrix (Hartig, 1838)	***Diprion pini*** (Diprionidae): Hellrigl 1994 (s. a. Hellrigl 1996, 1997); Hellrigl 2004; New record: 1 ♂, Piemonte, Torino, leg. G. Della Beffa, det. CE (MSNV) ***Gilpinia socia*** (Diprionidae): Hellrigl 1996 (s. a. Hellrigl 1997)
Parasetigena silvestris (Robineau-Desvoidy, 1863)	***Lymantria dispar*** (Lymantriidae): Luciano et al. 1982; Luciano & Prota 1986 ***Lymantria monacha*** (Lymantriidae): Hellrigl 1994 (s. a. Hellrigl 1995); Hellrigl 1997 (s. a. Hellrigl 2004)
Phorocera obscura (Fallén, 1810) [*caesifrons* Macquart]	***Operophtera brumata*** (Geometridae): Silvestri 1941; New record: 3 ♂♂, 1 ♀, Campania, Avellino prov., Vallefondi, 10.IV.1942, det. CE (DEZA)
Bessa parallela (Meigen, 1824) [*fugax* Rondani; misid. as *Ptychomyia selecta* and *Phorinia aurifrons* by Servadei 1930, rev. HE; misid. as *Ptychomyia selecta* by Melis 1936 and Grandi 1958]	[***Neoglanis salviae*** (Curculionidae): Mellini 1960b] [atypical host] ***Nycteola asiatica*** (Nolidae): Cavalcaselle & De Bellis 1968 (s. a. IOBC-List 8) ***Nycteola revayana*** (Nolidae): handwritten note of HE ("Bologna") ***Argyrotaenia ljungiana*** (Tortricidae): Carl & Zwölfer 1965 ***Laspeyresia molesta*** (Tortricidae): Melis 1936 ***Zeiraphera griseana*** (Tortricidae): Herting 1960 [Wachtl, s. Tschorsnig & Herting 2005] ***Yponomeuta cagnagella*** (Yponomeutidae): Servadei 1930; New records: 1 ♂ (e. l.), Lazio, Roma prov., Zagarolo, host collected 6.VI. on *Euonymus europaeus*, em. 15.VI.1943, leg. Hartig, det. CE (MZUR); 2 ♂♂, Lombardia, Mantova prov., Marmirolo, Bosco della Fontana, V.2003, on *Euonymus europaeus*, leg. D. Whitmore, det. CE (CPC)

	Yponomeuta evonymella (Yponomeutidae): Mellini 1960b ***Yponomeuta malinellus*** (Yponomeutidae): New records: 8 ♂♂, 7 ♀♀, Piemonte, Torino prov., Coazze, VII.1951, leg. G. Della Beffa, det. CE (MSNV); 1 ♂, Campania, Naples prov., Caivano, 14.VI.1934, det. CE (DEZA) ***Yponomeuta padella*** (Yponomeutidae): Servadei 1930; IOBC-List 8 ***Yponomeuta rorrella*** (Yponomeutidae): Grandi 1958; Mellini 1960b ***Yponomeuta*** sp. (Yponomeutidae): New records: 1 ♂, 11 ♀♀, Campania, Caserta prov., Sessa Aurunca, 1. and 9.VII.1936; 10 ♂♂, 2 ♀♀, Campania, Avellino prov., Monteforte superiore, 2. and 4.VII.1928, 5. and 6.VII.1929; 3 ♀♀, Campania, Salerno prov., Arenabianca, VII.1941, all det. CE (DEZA)
Bessa selecta (Meigen, 1824)	***Nematus melanaspis*** (Tenthredinidae): Mellini 1960a ***Nematus pavidus*** (Tenthredinidae): Frilli & Pizzaghi 1975
Meigenia dorsalis (Meigen, 1824)	***Chrysolina americana*** (Chrysomelidae): IOBC-List 14 ***Chrysomela populi*** (Chrysomelidae): IOBC-List 10
Meigenia mutabilis (Fallén, 1810) ["*floralis* Fallén"; older identifications of *mutabilis* might belong to a different species of *Meigenia* and need to be confirmed; confirmed records have an asterisk * in the right column]	***Agelastica alni*** (Chrysomelidae): Baronio 1973b ***Chrysolina americana*** (Chrysomelidae): Bibolini 1964 ***Chrysolina fastuosa*** (Chrysomelidae): Mellini 1958 ***Chrysolina herbacea*** (Chrysomelidae): Mellini & Callegarini 1968 (s. a. Mellini & Cucchi 1966) ***Chrysomela populi*** (Chrysomelidae): Baronio 1973b ***Chrysomela*** sp. (Chrysomelidae): New record: 2 ♂♂, 1 ♀ (e. l.), Campania, Salerno prov., San Severino, 6.VIII.1917, det. CE (DEZA)* ***Crioceris asparagi*** (Chrysomelidae): Ruffo 1938; Tschorsnig & Herting 1998* ***Hydrothassa marginella*** (Chrysomelidae): Ruffo 1938 ***Phytodecta fornicata*** (Chrysomelidae): Mellini 1954c; Michieli 1957 ***Plagiodera versicolora*** (Chrysomelidae): Mellini 1957b (s. a. Mellini & Cucchi 1966); Mellini 1968; Baronio 1973b ***Athalia rosae*** (Tenthredinidae): Martelli 1932; New record: 1 ♂, Emilia-Romagna, Bologna, 29.IX.1953, det. HE, TS (IEGG)*
Meigenia simplex Tschorsnig & Herting, 1998 [misid. as *M. mutabilis* by Albertoni 1962 and Mellini 1962b; rev. Tschorsnig & Herting 1998]	***Chrysomela populi*** (Chrysomelidae): Mellini 1962b (s. a. Mellini & Cucchi 1966); Farneti et al. 1998; Tschorsnig & Herting 1998 ***Chrysomela*** sp. (Chrysomelidae): Tschorsnig & Herting 1998 ***Crioceris asparagi*** (Chrysomelidae): Tschorsnig & Herting 1998 ***Phratora laticollis*** (Chrysomelidae): Albertoni 1962
Meigenia uncinata Mesnil, 1967 [misid. as *Meigenia mutabilis* by Mellini; the figures of the male genitalia show *M. uncinata*]	***Agelastica alni*** (Chrysomelidae): Mellini 1954c ***Altica brevicollis*** (Chrysomelidae): New record: 1 ♂, Lombardia, Varese prov., Ispra, 7.VII.1975, det. HE, TS (SMNS)
Zaira cinerea (Fallén, 1810) [*Viviania*, *pacta*]	***Carabus coriaceus*** (Carabidae): Faggioli 1937; Sturani 1962 [Sturani cites more species of *Carabus* as hosts, but it is not clear if all Tachinidae were *Z. cinerea*]; handwritten note of HE ("Mellini") ***Carabus morbillosus*** (Carabidae): New record: 2 ♂♂, 6 puparia, Sardinia, Sassari prov., Olmedo, località Pulpazos, host collected 23.III.2009, em. 14.IV.2009, leg. R. Pantaleoni, det. CE (CRP) ***Carabus solieri*** (Carabidae): Sturani 1962 ***Carabus violaceus*** (Carabidae): New record: 1 ♂, Lazio, Roma città, Via Tuscolana, 29.IX.1938, leg. Cerruti, det. CE (MZUR) ***Zabrus tenebrioides*** (Carabidae): Porta 1900 ***Triodonta raymondi*** (Melolonthidae): Prota 1964
Medina collaris (Fallén, 1820) [*Degeeria*]	***Xanthogaleruca luteola*** (Chrysomelidae): Thompson 1920
Medina luctuosa (Meigen, 1824) [Mellini's 1957b material was confirmed by Herting 1971]	***Altica brevicollis*** (Chrysomelidae): New records: 1 ♂, 1 ♀, Lombardia, Varese prov., Ispra, 9.VI.1975, det. TS (SMNS); 1 ♀, Emilia-Romagna, Bologna prov., Pontecchio, det. CE (IEGG) ***Altica quercetorum*** (Chrysomelidae): Mellini 1957b; New record: 1 ♀, Puglia, Foggia prov., Gargano, det. CE (IEGG) **Alticinae** gen. sp. (Chrysomelidae): Herting 1971

Medina separata (Meigen, 1824) [misid. as *Degeeria luctuosa* Meigen by Golfari 1946, corr. by Herting 1971; misid. as *D. luctuosa* by Grandori et al. 1952 and Domenichini 1953, but the figures of the female terminalia in the latter paper clearly show that it was *M. separata*]	***Phratora vitellinae*** (Chrysomelidae): Herting 1971 ***Plagiosterna aenea*** (Chrysomelidae): Grandori et al. 1952 (s. a. Domenichini 1953) ***Hippodamia undecimnotata*** (Coccinellidae): Golfari 1946 ***Psyllobora vigintiduopunctata*** (Coccinellidae): handwritten note of HE ("Mellini")
Medina sp. [larvae recorded as *Degeeria luctuosa* by Mellini 1957b; should be *M. separata* if Mellini's statement is correct that they belong to the same species as described by Domenichini 1953, but Mellini also refers to the material from *A. quercetorum* which was indeed *M. luctuosa*]	***Plagiodera versicolora*** (Chrysomelidae): Mellini 1957b ***Propylea quatuordecimpunctata*** (Coccinellidae): New record: 1 puparium (not identifiable to species level), Lombardia, Mantova prov., Marmirolo, Bosco della Fontana, VI.2005, leg. F. Mason, det. CE (CPC)
Policheta unicolor (Fallén, 1820) [*Perichaeta*; the single specimen of *P. unicolor* (pinned in a box with Chrysomelidae) in the collection Della Beffa was correctly identified, confirmed by CE]	***Chrysolina grossa*** (Chrysomelidae): Della Beffa 1947 ***Leptinotarsa decemlineata*** (Chrysomelidae): Della Beffa 1947
Ligeria angusticornis (Loew, 1847) [*Anachaetopsis angustifrons* Loew]	***Calyciphora nephelodactya*** (Pterophoridae): handwritten note of HE ("Val Susa, leg. E. Jäckh")
Erynniopsis antennata (Rondani, 1861) [misid. as *Erynnia nitida* by Rondani 1870, Silvestri 1910 and Thompson 1920; Silvestri's material was determined by Villeneuve 1934 as *Anachaetopsis nitidula* Villeneuve (= *E. antennata*)]	***Xanthogaleruca luteola*** (Chrysomelidae): Rondani 1870; Silvestri 1910; Thompson 1920; handwritten note of HE ("Mellini"); New records: 1 ♀, Emilia-Romagna, Bologna prov., Crevalcore, 30.VII.2004, leg. A. Reggiani, det. TS; 15 ♂♂, 14 ♀♀, Liguria, Genova prov., Nostra Signora della Vittoria, em. VIII.1943, leg. G. Mantero, det. CE (MZUR)
Blondelia inclusa (Hartig, 1838)	***Diprion pini*** (Diprionidae): Hellrigl 1996 (s. a. Hellrigl 1997) ***Gilpinia frutetorum*** (Diprionidae): Hellrigl 1997 (s. a. Hellrigl 2004) ***Gilpinia socia*** (Diprionidae): Hellrigl 1997 (s. a. Hellrigl 2004)
Blondelia nigripes (Fallén, 1810) [*Lydella, virilis* Rondani; prb. misid. by Cecconi 1912 as *Lydella angelicae* = prb. *B. nigripes*]	***Diprion pini*** (Diprionidae): Hellrigl 2004 ***Athalia rosae*** (Tenthredinidae): Martelli 1946 ***Operophtera brumata*** (Geometridae): New records: 1 ♀, Marche, Macerata prov., Acquacanina, 17.VII.1941, det. CE (DEZA); 1 ♂, Campania, Avellino prov., Quindici, San Romano, 1941, det. CE (DEZA) ***Eriogaster catax*** (Lasiocampidae): handwritten note of HE ("Mellini") ***Euproctis chrysorrhoea*** (Lymantriidae): Burgess & Crossman 1929; Frilli & Pizzaghi 1975; Currado et al. 1988 (s. a. IOBC-List 11); handwritten note of HE ("Mellini, Emilia") ***Cosmia trapezina*** (Noctuidae): IOBC-List 8 ***Mythimna unipuncta*** (Noctuidae): New record: 3 ♂♂, 1 ♀ (e. p.), Friuli-Venezia Giulia, Pordenone prov., San Quirino, 110 m, 13.–21.IX.2007, leg. G. Governatori, det. CE (CGG) ***Proxenus hospes*** (Noctuidae): Sannino et al. 2001 (s. a. IOBC-List 13) **Noctuidae** gen. sp.: IOBC-List 8 ***Pieris*** sp. (Pieridae): New record: 1 ♀, Piemonte, Torino, leg. G. Della Beffa, det. CE (MSNV) ***Tortrix viridana*** (Tortricidae): Cecconi 1912
Compsilura concinnata (Meigen, 1824) [*Doria, Macherea, Masicera, Phorocera, serriventris* Rondani]	***Hyphantria cunea*** (Arctiidae): Allegro 1987; Tiberi & Bin 1987 (s. a. Bin et al. 1994); Nanni et al. 1989 (s. a. Nanni 1991); IOBC-List 12; Marchesini et al. 1998; Camerini & Groppali 1999; Cerretti & Tschorsnig 2002; New record: 2 ♂♂, 2 ♀♀, Emilia-Romagna, Bologna, X.2004, leg. L. Sighinolfi, det. TS ***Lithosia quadra*** (Arctiidae): Luciano & Roversi 2001 ***Danaus chrysippus*** (Danaidae): IOBC-List 14 ***Colotois pennaria*** (Geometridae): Luciano & Roversi 2001 ***Hepialus humuli*** (Hepialidae): Bezzi 1891 ***Eriogaster lanestris*** (Lasiocampidae): Herting 1960 [Wachtl, s. Tschorsnig & Herting 2005]

	Gastropacha quercifolia (Lasiocampidae): Luciano & Roversi 2001 ***Calliteara pudibunda*** (Lymantriidae): Mazzoglio et al. 2005 ***Euproctis chrysorrhoea*** (Lymantriidae): Faggioli 1937; Delrio & Luciano 1985; handwritten note of HE ("Bologna") ***Lymantria dispar*** (Lymantriidae): Bezzi 1891; Luciano & Prota 1986; IOBC-List 11; IOBC-List 14; Camerini 2009 ***Orgyia antiqua*** (Lymantriidae): Luciano & Roversi 2001 ***Orgyia rupestris*** (Lymantriidae): Leipnitz & Tschorsnig 2005 ***Acronicta rumicis*** (Noctuidae): New record: 1 ♀ (e. p.), Campania, near Naples, Lago Fusaro, em. 15.II.1940, leg. Hartig, det. CE (MZUR) ***Mamestra brassicae*** (Noctuidae): Menozzi 1947 ***Phalera bucephala*** (Notodontidae): Faggioli 1932; Faggioli 1934; handwritten note of HE ("Bologna") ***Inachis io*** (Nymphalidae): Rondani 1861; Bezzi 1892; Mellini 1957a ***Nymphalis antiopa*** (Nymphalidae): Hellrigl 2004 ***Nymphalis polychloros*** (Nymphalidae): IOBC-List 14 ***Iphiclides podalirius*** (Papilionidae): IOBC-List 14 ***Aporia crataegi*** (Pieridae): Martelli 1931 ***Pieris brassicae*** (Pieridae): Martelli 1907; Frilli & Pizzaghi 1975; IOBC-List 14 ***Saturnia pavonia*** (Saturniidae): New record: 1 ♀ (e. l.), Sicilia, Messina prov., Rotiro, 100 m, 15.VI.1950, leg. Hartig & Grisham, det. CE (MZUR) ***Thaumetopoea processionea*** (Thaumetopoeidae): New record: 15 ♂♂, 15 ♀♀, Lombardia, Pavia prov., Bereguardo and Zerbolò, V.–VI.2001, leg. G. Camerini & P. F. Roversi, det. TS (SMNS) ***Traumatocampa pityocampa*** (Thaumetopoeidae): Herting 1960 [Wachtl, s. Tschorsnig & Herting 2005]; IOBC-List 5; Lo Duca 2008; New record: 1 ♀, Friuli-Venezia Giulia, Trieste, 22.III.1968, leg. K. Keller, det. TS (SMNS) ***Tortrix viridana*** (Tortricidae): Cecconi 1912; Silvestri 1923; Delrio et al. 1988 (s. a. Luciano & Roversi 2001) ***Yponomeuta malinellus*** (Yponomeutidae): New record: 1 ♂, Campania, Naples prov., Caivano, 18.VI.1934, det. CE (DEZA)
Vibrissina turrita (Meigen, 1824)	***Arge ochropus*** (Argidae): Campadelli 1986; Campadelli 1997 (s. a. Campadelli & Crudele 1998) ***Arge pagana*** (Argidae): Servadei 1934 ***Arge*** sp. (Argidae): IOBC-List 11
Metacemyia calloti (Séguy, 1936) [as *Acemyia subrotunda* = prb. misid. *M. calloti*]	***Anacridium aegyptium*** (Acrididae): Ribaga 1902
Thrixion aberrans (Schiner, 1862) [*halidayanum*]	***Clonopsis gallica*** (Phylliidae): Bullini 1978
Ethilla aemula (Meigen, 1824) [one specimen examined differs from typical *E. aemula* in having 2 pairs of lateral scutellar setae and tergite 3 entirely covered with pruinescence]	***Pseudoterpna pruinata*** (Geometridae): New record: 2 ♂♂, 2 ♀♀ (e. p.), Friuli-Venezia Giulia, Udine prov., Campoformido, near Basaldella, 80 m, host collected 18.VI.1999, em. 25.VII.1999, leg. C. Morandini, det. CE (MFNB)
Paratryphera bisetosa (Brauer & Bergenstamm, 1891)	**Geometridae** gen. sp.: New record: 1 ♂, Veneto, Venezia prov., Caorle, Valle la Brusa, VII.1998, leg. C. Morandini, det. CE (MFNB)
Smidtia conspersa (Meigen, 1824)	***Agriopis leucophaearia*** (Geometridae): Leipnitz & Tschorsnig 2005
Nemorilla maculosa (Meigen, 1824) [older records of *Nemorilla floralis* or *N. notabilis* from Italy (Martelli 1916, Colizza 1927, Thompson & Parker 1928, Martelli 1938, Faggioli 1939, Lucchese 1941, Zambelli 1958, Zambelli 1960, Ivancich Gambaro 1968) are doubtful – it is likely that it was *N. maculosa* in all those cases; *N. floralis* of Faggioli 1937 was *N. maculosa*, rev. HE; Menozzi 1947 used the name "*Ceromasia senilis* Meig." for *N. maculosa*, rev. CE]	***Ostrinia nubilalis*** (Crambidae): Thompson & Parker 1928 ***Palpita vitrealis*** (Crambidae): Martelli 1916; Triggiani 1971 ***Udea ferrugalis*** (Crambidae): Menozzi 1947 ***Uresiphita gilvata*** (Crambidae): Nuzzaci 1973; IOBC-List 11; New record: 2 ♂♂, 1 ♀ (e. l.), Trentino-Alto Adige, near Bolzano, Haslach, 6.IX.1947, det. CE (MZUR) ***Agonopterix subpropinquella*** (Depressariidae): Faggioli 1939 (s. a. Martelli 1954); Prota 1960 ***Depressaria marcella*** (Depressariidae): Zambelli 1958; Zambelli 1960; Mellini 1964; Celli 1968 ***Depressaria*** sp. (Depressariidae): Tschorsnig 1997b

	Mythimna unipuncta (Noctuidae): handwritten note of HE ("Mellini, Maccarese") ***Archips podana*** (Tortricidae): handwritten note of HE ("Mellini, Malborghetto") ***Archips rosana*** (Tortricidae): New record: 1 specimen, Piemonte, Torino prov., Val Susa, Bizio, VIII.1952, leg. G. Della Beffa, det. CE (MSNV) ***Argyrotaenia ljungiana*** (Tortricidae): New record: 1 ♀, Emilia-Romagna, Bologna prov., Crevalcore, 12.VIII.1998, leg. A. Reggiani, det. TS ***Cacoecimorpha pronubana*** (Tortricidae): Colizza 1927 ***Choristoneura lafauryana*** (Tortricidae): Ivancich Gambaro 1968 ***Cnephasia chrysantheana*** (Tortricidae): Martelli 1938 ***Epichoristodes acerbella*** (Tortricidae): Nuzzaci 1973; Fenili 1977 ***Pandemis dumetana*** (Tortricidae): Ivancich Gambaro 1968 ***Rhopobota naevana*** (Tortricidae): Lucchese 1941 ***Tortrix viridana*** (Tortricidae): Silvestri 1923; New record: 4 ♂♂, Piemonte, Torino prov., Val Susa, Bizio, VIII.1952, leg. G. Della Beffa, det. CE (MSNV) ***Zeiraphera griseana*** (Tortricidae): Faggioli 1937; Hellrigl 2004; Tschorsnig & Herting 2005 ***Zeiraphera rufimitrana*** (Tortricidae): Schedl 1963 **Tortricidae** gen. sp.: New record: 4 ♂♂, 6 ♀♀, Campania, Naples prov., Ercolano, Resina, 14.–25.VIII.1924, det. CE (DEZA) ***Yponomeuta sedella*** (Yponomeutidae): Servadei 1930
Aplomya confinis (Fallén, 1820) [*Aplomyia*, *Zenillia*]	***Cacyreus marshalli*** (Lycaenidae): Vicidomini & Vatore 2007 (s. a. Vicidomini & Dindo 2007) ***Lycaena dispar*** (Lycaenidae): IOBC-List 14 ***Neozephyrus quercus*** (Lycaenidae): Luciano & Roversi 2001 (s. a. IOBC-List 5) ***Satyrium ilicis*** (Lycaenidae): Fiori 1957 ***Scolitantides orion*** (Lycaenidae): IOBC-List 14
Nilea hortulana (Meigen, 1824)	***Acronicta psi*** (Noctuidae): handwritten note of HE ("Bologna")
Nilea innoxia Robineau-Desvoidy, 1863 [Rondani 1877 and Martelli & Arru 1958 use *Zenillia* (or *Exorista*) *fauna* Meigen in the sense of Rondani, which is a synonym of *N. innoxia*, but a misid. cannot be ruled out]	[***Euproctis chrysorrhoea*** (Lymantriidae): Rondani 1877] [***Lymantria dispar*** (Lymantriidae): Martelli & Arru 1958] ***Acronicta rumicis*** (Noctuidae): Prota 1974; New record: 2 ♂♂, 2 ♀♀, Friuli-Venezia Giulia, Udine prov., Campoformido, Basaldella, 80 m, em. 8.X.2002, leg. C. Morandini, det. CE (MFNB) ***Smerinthus ocellatus*** (Sphingidae): Prota 1974
Buquetia musca Robineau-Desvoidy, 1847	***Papilio machaon*** (Papilionidae): Ford et al. 2000; IOBC-List 14; New record: 1 ♂, 1 ♀ (e. l.), Sardegna, Cagliari prov., Abba Currente, Platamona, host collected 11.VII.2004, pupated 17.VII.2004, em. 27.VII.2004, leg. G. Delitala, det. CE (CPC)
Phryxe caudata (Rondani, 1859) [misid. by Cecconi 1924 as *Lydella lepida* = prb. *P. caudata*]	***Traumatocampa pityocampa*** (Thaumetopoeidae): Cecconi 1924; IOBC-List 5; IOBC-List 11; Buxton 1990; IOBC-List 12; Triggiani et al. 1993; Hellrigl 1997; Tschorsnig 1997a; Triggiani & Tarasco 2001; Triggiani & Tarasco 2002; Tschorsnig & Herting 2005; Lo Duca 2008
Phryxe erythrostoma (Hartig, 1838)	***Sphinx pinastri*** (Sphingidae): IOBC-List 13
Phryxe hirta (Bigot, 1880)	***Heterogynis penella*** (Heterogynidae): Freina & Tschorsnig 2005
Phryxe magnicornis (Zetterstedt, 1838)	***Ematurga atomaria*** (Geometridae): New record: 4 ♂♂, 4 ♀♀ (e. l.), Friuli-Venezia Giulia, Udine prov., Campoformido, Basaldella, San Daniele, 80 m, host collected 10.X.1999, em. 31.III.–13.IV.2000, leg. C. Morandini, det. CE (MFNB) ***Zygaena transalpina*** (Zygaenidae): New record: 1 ♂, Trentino-Alto Adige, Trento prov., Madonna di Campiglio, 28.VIII.1939, leg. Hartig, det. CE (MZUR)
Phryxe nemea (Meigen, 1824)	***Neozephyrus quercus*** (Lycaenidae): Luciano & Roversi 2001 ***Cosmia trapezina*** (Noctuidae): Luciano & Roversi 2001 ***Orthosia cruda*** (Noctuidae): Luciano & Roversi 2001 ***Tortrix viridana*** (Tortricidae): Delrio et al. 1988 (s. a. IOBC-List 11, Luciano & Roversi 2001)

Phryxe semicaudata Herting, 1959 [*Tricholyga caudata* of Rondani 1874 and *Ceratochaeta caudata* of Faggioli 1932 are probably misid. of this species]

[***Lymantria dispar*** (Lymantriidae): New record: 3 ♂♂, Toscana, Firenze prov., Vallombrosa, IV.1882, det. CE (MZUF)] [*P. semicaudata* is a specific parasitoid of *Thaumetopoea*, so it is unlikely that this old host association is correct; *Lymantria dispar* is very commonly reared, its parasitoids are well-known, and *P. semicaudata* was never found in those rearings]
Thaumetopoea processionea (Thaumetopoeidae): Rondani 1874; Faggioli 1932; IOBC-List 11; New record: 1 ♂ (e. p.), Liguria, Genova prov., Amborzasco, host larva collected VIII.1912, em. V.1913, leg. Mantero, det. CE (MSNG)

Phryxe setifacies (Villeneuve, 1910)

Zygaena transalpina (Zygaenidae): IOBC-List 9

Phryxe vulgaris (Fallén, 1810)

[***Neoglanis salviae*** (Curculionidae): Mellini 1960b] [atypical host]
Lycia florentina (Geometridae): handwritten note of HE ("Mellini, Crespellano")
Agrotis ipsilon (Noctuidae): handwritten note of HE ("Mellini, Budrio")
Autographa gamma (Noctuidae): Menozzi 1947
Macdunnoughia confusa (Noctuidae): IOBC-List 6
Inachis io (Nymphalidae): Mellini 1957a; New record: 4 ♂♂, 3 ♀♀, Piemonte, Torino prov., Canavesano, Valprato Soana, leg. G. Della Beffa, det. CE (MSNV)
Nymphalis antiopa (Nymphalidae): Cecconi 1924
Aporia crataegi (Pieridae): handwritten note of HE ("Bologna")
Pieris brassicae (Pieridae): Faggioli 1934

Gymnophryxe carthaginiensis (Bischof, 1900)

Ocnogyna baetica (Arctiidae): Herting 1960

Bactromyia aurulenta (Meigen, 1824)

Nycteola asiatica (Nolidae): IOBC-List 8
Yponomeuta padella (Yponomeutidae): IOBC-List 8

Pseudoperichaeta nigrolineata (Walker, 1853) [*Zenillia roseanae* B. B., *insidiosa* Robineau-Desvoidy, *major* (sensu Stein); misid. as *Exorista confinis* by Faggioli 1932, rev. HE]

Ostrinia nubilalis (Crambidae): Thompson & Parker 1928; Goidanich 1931; Martelli 1938; Carilli 1952; New records: 2 ♂♂, 1 ♀, Lombardia, Bergamo, det. TS (SMNS); 2 ♂♂, 1 ♀, [no locality data] 568-B (C), 2.–3.VIII.1921, det. CE (DEZA)
Uresiphita gilvata (Crambidae): New records: 2 ♂♂, Campania, Naples prov., Portici, det. CE (DEZA); 6 ♂♂, 7 ♀♀, Campania, Naples prov., Ercolano, Resina, 16.–21.VII.1947, det. CE (DEZA)
Lampides boeticus (Lycaenidae): IOBC-List 10
Spodoptera exigua (Noctuidae): Menozzi 1947
Nycteola asiatica (Nolidae): Cavalcaselle & De Bellis 1968 (s. a. IOBC-List 8)
Dioryctria abietella (Pyralidae): Herting 1960 [the Wachtl material, according to an old handwritten note of HE from Gradisca, could not be found again by Tschorsnig & Herting 2005]
Archips podana (Tortricidae): handwritten note of HE ("Mellini, Galliera")
Archips rosana (Tortricidae): Gentilucci 1952
Argyrotaenia ljungiana (Tortricidae): New record: 2 ♂♂, Emilia-Romagna, Bologna prov., Crevalcore, 3. and 10.VI.1998, leg. A. Reggiani, det. TS
Choristoneura lafauryana (Tortricidae): Castellari 1983
Cydia sp. (Tortricidae): IOBC-List 12
Grapholita funebrana (Tortricidae): IOBC-List 11
Hedya nubiferana (Tortricidae): handwritten note of HE ("Mellini")
Pandemis cerasana (Tortricidae): New record: 4 ♂♂, 5 ♀♀, Emilia-Romagna, Bologna and Modena, 1998–1999, leg. A. Reggiani, det. TS
Pandemis sp. (Tortricidae): New record: 1 ♂, 1 ♀, Modena, Nonantola, 1999, leg. A. Reggiani, det. TS
Rhyacionia buoliana (Tortricidae): Faggioli 1932; IOBC-List 5; IOBC-List 11; New records: 4 ♀♀, Piemonte, Torino, VI.1922, leg. G. Della Beffa, det. CE (MSNV); 2 ♀♀, Emilia-Romagna, Modena prov., Marano sul Panaro, 3.VII.1928, det. CE (IEGG)
Tortrix viridana (Tortricidae): Silvestri 1923

Pseudoperichaeta palesioidea (Robineau-Desvoidy, 1830) ["*Arioxycampta*" *trizonata* Zett.; Martelli's record might also belong to *P. nigrolineata* because he cites "*Phorocera nigripalpis* Rond" as a wrong synonym of *Anoxycampta hirta* Bigot sensu Stein]

Depressaria marcella (Depressariidae): Mellini 1964; Celli 1968
Spodoptera exigua (Noctuidae): Menozzi 1947 [rev. CE]
Cnephasia chrysantheana (Tortricidae): Martelli 1938

Lydella stabulans (Meigen, 1824)	***Gortyna xanthenes*** (Noctuidae): IOBC-List 10; Parenzan et al. 1985 (s. a. IOBC-List 11) [= Tachinidae sp. of Sinacori 1985]
Lydella thompsoni Herting, 1959 [misid. as "*Lydella grisescens*", "*Lydella stabulans grisescens*", *Ceromasia (Masicera, Paraphorocera) senilis* var.]	***Ostrinia nubilalis*** (Crambidae): Thompson 1922 (s. a. Thompson & Thompson 1923); Thompson & Parker 1928; Goidanich 1931; Martelli 1938; Carilli 1952; Maini 1972; Maini 1974; Frilli & Pizzaghi 1975; Platia & Maini 1975; Barbattini 1986; Maini & Burgio 1990; Camerini & Quadrelli 1991; Camerini 1995; Manachini 2000; Manachini 2003 (s. a. Manachini & Lozzia 2004); handwritten note of HE ("Mellini, Galliera"); New records: 9 ♂♂, 10 ♀♀, Campania, Salerno prov., Scafati, V.1928, 18. and 20.V.1932; 1 ♂, 4 ♀♀, Campania, Naples prov., Acerra, 16. and 24.V.1940, 10.VI.1940, all det. CE (DEZA) ***Sesamia cretica*** (Noctuidae): Platia & Maini 1975; Campadelli & Baronio 1981
Chetina setigena Rondani, 1856 [*Chaetolya*]	[***Athroolopha chrysitaria*** (Geometridae): Brauer & Bergenstamm 1889] [host unlikely; a currently confirmed host belongs to Lycaenidae (s. Ford et al. 2000)]
Drino atropivora (Robineau-Desvoidy, 1830) [*Blepharipa*, *Masicera*]	***Acherontia atropos*** (Sphingidae): Macquart 1850; Rondani 1861; Faggioli 1932; IOBC-List 11; IOBC-List 14; New record: 18 ♂♂, 2 ♀♀, Lazio, Roma, Montesacro, 27.II.2005, leg. A. Zilli, det. CE (CPC) ***Agrius convolvuli*** (Sphingidae): Sannino et al. 2001 (s. a. IOBC-List 13); New record: 7 ♂♂, 7 ♀♀, Umbria, Perugia prov., Umbertide, Fiume Tevere, 28.IX.2006, em. 16.X.2006, leg. A. Hundsdörfer, det. TS (SMNS) ***Sphinx ligustri*** (Sphingidae): IOBC-List 14
Drino gilva (Hartig, 1838)	***Diprion pini*** (Diprionidae): Hellrigl 1996; New record: 1 ♀, Valle d'Aosta, Aosta prov., Saint Nicolas, 1915, det. CE (MSNV) ***Gilpinia socia*** (Diprionidae): Hellrigl 1996 (s. a. Hellrigl 1997)
Drino inconspicua (Meigen, 1830) [*Sturmia*; misid. as *Erycia gyrovaga* Rond. by Faggioli 1931, rev. HE, TS; *Masicera gyrovaga* of Rondani 1861 and Rondani 1872b is prb. a misid. of *D. inconspicua*]	***Diprion pini*** (Diprionidae): Rondani 1861; Hellrigl 1996 (s. a. Hellrigl 1997); Hellrigl 2002; Hellrigl 2004 ***Diprion similis*** (Diprionidae): IOBC-List 9; Hellrigl 1996 (s. a. Hellrigl 1997) ***Gilpinia pallida*** (Diprionidae): Hellrigl 1996 ***Gilpinia socia*** (Diprionidae): Hellrigl 1996 ***Neodiprion sertifer*** (Diprionidae): Rondani 1872b; Faggioli 1931 [1 ♀ of this series in SMNS] ***Pristiphora erichsonii*** (Tenthredinidae): Frilli 1964 (s. a. Frilli & Pizzaghi 1975) ***Lymantria dispar*** (Lymantriidae): Burgess & Crossman 1929; IOBC-List 11
Drino vicina (Zetterstedt, 1849)	***Hyles livornica*** (Sphingidae): New record: 1 ♀, Puglia, Bari prov., Molfetta, 20.VI.1928, det. CE (DEZA)
Hubneria affinis (Fallén, 1810) [*Huebneria*]	***Arctia caja*** (Arctiidae): New record: 2 ♂♂, 2 ♀♀ (e. l.), Friuli-Venezia Giulia, Pordenone prov., Prealpi Carniche, Barcis, Torrente Prescudin, em. 29.VI.1976, det. CE (MFNB) ***Phragmatobia fuliginosa*** (Arctiidae): Sannino et al. 2001 (s. a. IOBC-List 12, IOBC-List 13)
Tryphera lugubris (Meigen, 1824)	***Amata kruegeri*** (Arctiidae): New record: 2 ♀♀, Trentino-Alto Adige, Trento prov., Nago, 27.V.1930, coll. Engel, det. TS (SMNS)
Carcelia alpestris Herting, 1966 [under *lucorum* Meigen in Herting 1960]	***Arctia flavia*** (Arctiidae): Herting 1966
Carcelia bombylans Robineau-Desvoidy, 1830	***Hyphantria cunea*** (Arctiidae): Nanni et al. 1989 (s. a. Nanni 1991) **Arctiidae** gen. sp.: handwritten note of HE ("Mellini"); New record: 1 specimen, Forlì, Longiano, leg. De Giovanni, det. TS
Carcelia dubia (Brauer & Bergenstamm, 1891) [under *lucorum* Meigen in Herting 1960]	***Tyria jacobaeae*** (Arctiidae): Herting 1966
Carcelia falenaria (Rondani, 1859)	***Amata kruegeri*** (Arctiidae): New record: 1 ♂ (e. l.), Veneto, Verona prov., Lago di Garda, San Vigilio, em. 6.IV.1943, leg. Hartig, det. CE (MZUR) ***Amata*** sp. (Arctiidae): New record: 5 ♂♂, 4 ♀♀ (e. l.), Sicilia, Palermo prov., Bosco della Ficuzza, Rocco Busambra, 800 m, 8.V.2004, leg. P. Cerretti & D. Whitmore, det. CE (CPC)

Carcelia gnava (Meigen, 1824)	***Leucoma salicis*** (Lymantriidae): Frediani 1955
Carcelia iliaca (Ratzeburg, 1840) [*Exorista lucorum* of Rondani 1874, cited as *E. gnava* in Rondani 1877 and 1878, is prb. a misid. of this species; *Carcelia excisa* of Cecconi 1924 is prb. a misid. of *C. iliaca*]	***Thaumetopoea processionea*** (Thaumetopoeidae): Rondani 1874; Cecconi 1924; New record: 11 ♂♂, 9 ♀♀, Lombardia, Pavia prov., Bereguardo, coll. 2001, em. 23.–30.IV.2002, leg. G. Camerini & P. F. Roversi, det. TS
Carcelia laxifrons Villeneuve, 1912	***Euproctis chrysorrhoea*** (Lymantriidae): Burgess & Crossman 1929; Delrio & Luciano 1985
Carcelia lucorum (Meigen, 1824) [*Exorista lateralis* Bigot; *Exorista cheloniae* Rondani, confirmed by Herting 1969; *Exorista confundens* of Rondani 1877 is prb. misid.]	***Arctia caja*** (Arctiidae): Rondani 1859 ***Arctia villica*** (Arctiidae): Rondani 1877 (s. a. Rondani 1878); Herting 1966 (s. a. Herting 1960) ***Arctia*** sp. (Arctiidae): New record: 2 ♂♂, 1 ♀ (e. l.), Veneto, Verona prov., Grezzana, Apicoltura la Cava, larva collected 18.III., em. 27.III.2008, leg. A. Cini & R. Cervo, det. CE (MZUF) ***Coscinia cribraria*** (Arctiidae): Bigot 1860 ***Cymbalophora pudica*** (Arctiidae): IOBC-List 14 ***Phragmatobia fuliginosa*** (Arctiidae): Rondani 1877; Sannino et al. 2001 (s. a. IOBC-List 13); Tschorsnig 1997b
Carcelia rasa (Macquart, 1849)	***Calliteara pudibunda*** (Lymantriidae): IOBC-List 11; Mazzoglio et al. 2005
Senometopia separata (Rondani, 1859)	***Lymantria dispar*** (Lymantriidae): IOBC-List 11; New records: 1 ♂, Liguria, Genova prov., Chiavari, IX.1927, B. OSS. FIT., det. CE (DEZA); 1 ♂, Lazio, Roma prov., Monti della Tolfa, Valle di Rio Fiume, 400 m, 26.VI.1969, leg. P. Maltzeff, det. CE (CPC)
Senometopia susurrans (Rondani, 1859)	**Geometridae** gen. sp.: Ford & Shaw 1991 **Lepidoptera** gen. sp. (on *Erba medica*): Frilli & Pizzaghi 1975
Thecocarcelia trichops Herting, 1967	***Carcharodus*** sp. [cf. ***alceae***] (Hesperiidae): New record: 1 ♀, Campania, Naples prov., Portici, on *Malva* sp., 24.VIII.1917, det. CE (DEZA)
Erycia fasciata Villeneuve, 1924	***Melitaea didyma*** (Nymphalidae): handwritten note of HE ("Forli, 30.V.1972")
Erycia furibunda (Zetterstedt, 1844)	***Euphydryas aurinia*** (Nymphalidae): Ford et al. 2000
Cestonia cineraria Rondani, 1861	***Archips xylosteana*** (Tortricidae): IOBC-List 5
Xylotachina diluta (Meigen, 1824)	***Cossus cossus*** (Cossidae): New record: 2 ♀♀, Sicilia, leg. E. Mellini, det. CE (IEGG)
Alsomyia capillata (Rondani, 1859)	***Zygaena erythrus*** (Zygaenidae): IOBC-List 9; Tschorsnig 1997b; Robertson & Shaw in prep. ***Zygaena rubicundus*** (Zygaenidae): IOBC-List 11 ***Zygaena*** sp. (Zygaenidae): New record: 1 ♂ (e. l.), Friuli-Venezia Giulia, Udine prov., Campoformido, Basaldella, San Daniele, 80 m, em. 14.V.2000, leg. C. Morandini, det. CE (MFNB)
Townsendiellomyia nidicola (Townsend, 1908) [*Alsomyia*, *Sturmia*, *Zygobothria*; misid. by Rondani 1872b as *Tricholyga properans* = prb. *Townsendiellomyia nidicola*]	***Euproctis chrysorrhoea*** (Lymantriidae): Rondani 1872b [*Lyparis auriflua* (= *Euproctis similis*) was prb. a wrongly associated host in a mixed rearing together with *E. chrysorrhoea*]; Townsend 1908; Howard & Fiske 1911; Burgess & Crossman 1929; Faggioli 1937; Currado et al. 1988 (s. a. IOBC-List 11); Delrio & Luciano 1985; Lo Verde & Massa 1995; IOBC-List 14; handwritten note of HE ("Emilia"), confirmed by CE (1 ♂, Bologna, Ronzano, 25.VI.1936, IEGG); New record: 2 ♂♂, 1 ♀, Calabria, Cosenza prov., San Giovanni in Fiore, 29.VI.1941 and 5.VII.1941, det. CE (DEZA) [***Traumatocampa pityocampa*** (Thaumetopoeidae): Faggioli 1937] [tachinid identification confirmed by CE (material in IEGG), but host unlikely because *T. nidicola* is a specific parasitoid of *Euproctis chrysorrhoea*]
Eumea mitis (Meigen, 1824) [*Exorista*]	***Acronicta psi*** (Noctuidae): Faggioli 1939

Myxexoristops bonsdorffi (Zetterstedt, 1859)	***Acantholyda posticalis*** (Pamphiliidae): Kenis & Kloosterman 2001
Myxexoristops hertingi Mesnil, 1955	***Acantholyda erythrocephala*** (Pamphiliidae): Kenis & Kloosterman 2001 (s. a. IOBC-List 14)
Myxexoristops sp. [material recorded as "*?hertingi* Mesnil" by Hellrigl 1996 and as "*?bonsdorffi* Zetterstedt" by Hellrigl 1997 and 2004]	***Acantholyda erythrocephala*** (Pamphiliidae): Hellrigl 1996 (s. a. Hellrigl 1997, 2004) [only larvae]
Zenillia dolosa (Meigen, 1824)	***Yponomeuta cagnagella*** (Yponomeutidae): New record: 1 ♂, 1 ♀ (e. l.), Lombardia, Mantova prov., Marmirolo, Bosco della Fontana, host larva collected 12.V.2008, parasite pupated 28.V.2008, em. 5.VI.2008, leg. D. Bujazha, det. CE (CPC) ***Yponomeuta padella*** (Yponomeutidae): IOBC-List 11
Zenillia libatrix (Panzer, 1798) [*Exorista*]	***Hyphantria cunea*** (Arctiidae): Allegro 1987 ***Colotois pennaria*** (Geometridae): New record: 1 ♀, Campania, Avellino prov., Mercogliano, 1.VI.1934, det. CE (DEZA) ***Euproctis chrysorrhoea*** (Lymantriidae): Burgess & Crossman 1929; Currado et al. 1988 (s. a. IOBC-List 11); New record: 1 ♂, 1 ♀, Sicilia, Messina prov., San Piero Patti, VI.1941, det. CE (DEZA) ***Clostera pigra*** (Notodontidae): Tschorsnig 1997b ***Thaumetopoea processionea*** (Thaumetopoeidae): Rondani 1874 ***Argyrotaenia ljungiana*** (Tortricidae): New record: 1 ♀, Emilia-Romagna, Bologna prov., San Giovanni in Persiceto, 26.VII.1999, leg. A. Reggiani, det. TS ***Pandemis cerasana*** (Tortricidae): New record: 1 ♂, Emilia-Romagna, Bologna prov., Sant'Agata bolognese, 2.VI.1999, leg. A. Reggiani, det. TS ***Theresimima ampellophaga*** (Zygaenidae): Pucci & Dominici 1986
Clemelis pullata (Meigen, 1824) [*Phorocera polleniella* Rondani]	**Geometridae** gen. sp.: Rondani 1859
Pales pavida (Meigen, 1824) [*Neopales*; prb. misid. as *P. pumicata* by Silvestri 1911 and Prota 1974; misid. as *P. pumicata* by Martelli & Arru 1958, corr. by Cerretti 2005; the specimens figured by Arzone 1970 are 12 mm long, so they could belong to *P. processioneae*; the egg shown in fig. 225 in Sannino et al. 2001 cannot belong to *P. pavida*]	***Hyphantria cunea*** (Arctiidae): IOBC-List 13; Camerini & Groppali 1999; New record: 2 ♂♂, 2 ♀♀, Emilia-Romagna, Bologna, X.2004, leg. L. Sighinolfi, det. TS ***Phragmatobia fuliginosa*** (Arctiidae): Sannino et al. 2001 (s. a. IOBC-List 12) [***Operophtera brumata*** (Geometridae): Silvestri 1941] [*O. brumata* is commonly reared and *P. pavida* is a common tachinid, but this host-parasitoid couple was never confirmed in other rearings] ***Pelurga comitata*** (Geometridae): New record: 1 ♀ (e. l.), Friuli-Venezia Giulia, Pordenone prov., Magredi di San Quirino, 102 m, em. 1.XI.2002, leg. C. Morandini, det. CE (MFNB) **Geometridae** gen. sp.: Robertson & Shaw in prep. ***Eriogaster lanestris*** (Lasiocampidae): Herting 1960 [Wachtl, s. Tschorsnig & Herting 2005] ***Lasiocampa quercus*** (Lasiocampidae): New record: 1 ♂ (e. l.), Lazio, Roma, Parco degli Acquedotti, em. 22.XII.2004, leg. V. Viglioglia, det. CE (CPC) ***Malacosoma franconicum*** (Lasiocampidae): New record: 1 ♂, Lazio, Roma prov., Tolfa, em. 17.VI.1996, leg. F. Vegliante, det. CE (CPC) ***Malacosoma neustria*** (Lasiocampidae): Martelli & Arru 1958; Prota 1974; Delrio et al. 1979; Delrio et al. 1983; Luciano & Roversi 2001 ***Calliteara pudibunda*** (Lymantriidae): Mazzoglio et al. 2005 ***Euproctis chrysorrhoea*** (Lymantriidae): Faggioli 1937; Delrio & Luciano 1985; Luciano & Roversi 2001; IOBC-List 14 ***Lymantria dispar*** (Lymantriidae): Delrio et al. 1979 ***Orgyia dubia*** (Lymantriidae): Nardelli & Giandolfo 2000 ***Autographa gamma*** (Noctuidae): Silvestri 1911; IOBC-List 11; Sannino et al. 2001 (s. a. IOBC-List 12) ***Axylia putris*** (Noctuidae): Sannino et al. 1990 (s. a. IOBC-List 11, Sannino et al. 2001) ***Caradrina*** sp. [cf. ***morpheus***] (Noctuidae): New record: 10 ♂♂, 2 ♀♀, Campania, Caserta prov., Piana di Caiazzo, 28.VII.1939, det. CE (DEZA) ***Cosmia trapezina*** (Noctuidae): Luciano & Roversi 2001 ***Dryobotodes monochroma*** (Noctuidae): Luciano & Roversi 2001 (s. a. IOBC-List 5)

	Lacanobia oleracea (Noctuidae): Menozzi 1938 (s. a. Menozzi 1947); IOBC-List 11; Sannino et al. 1993 ***Mythimna unipuncta*** (Noctuidae): handwritten note of HE ("Mellini, Maccarese"); New record: 1 ♂ (e. p.), Friuli-Venezia Giulia, Pordenone prov., San Quirino, 110 m, 25.IX.2007, leg. G. Governatori, det. CE (CGG) ***Ochropleura leucogaster*** (Noctuidae): New record: 2 ♀♀ (e. l.), Veneto, Venezia prov., Caorle, Brussa, Valle Vecchia, 3 m, 11.XI.2002, leg. C. Morandini, det. CE (MFNB) ***Orthosia cerasi*** (Noctuidae): IOBC-List 13 ***Peridroma saucia*** (Noctuidae): Sannino et al. 2001 (s. a. IOBC-List 13) ***Proxenus hospes*** (Noctuidae): Sannino et al. 2001 (s. a. IOBC-List 12) ***Shargacucullia prenanthis*** (Noctuidae): Tschorsnig 1997b ***Tyta luctuosa*** (Noctuidae): Rosenthal et al. 1988 **Noctuidae** gen. sp. (*Agrotis trux* or *Noctua comes*): Tschorsnig 1997b ***Pieris brassicae*** (Pieridae): New record: 1 ♂, 1 ♀ (e. l.), Lazio, Roma, Monte Mario, I.1939, leg. Barbera, det. CE (MZUR) ***Samia cynthia*** (Saturniidae): Arzone 1970 (s. a. Arzone 1971) ***Tortrix viridana*** (Tortricidae): Silvestri 1923; Delrio et al. 1988 (s. a. Luciano & Roversi 2001); New record: 1 ♂ (e. p.), Campania, Naples prov., Portici, 20.VI.1917, on *Quercus ilex*, det. CE (DEZA) ***Zygaena lonicerae*** (Zygaenidae): Herting 1960 [2 ♀♀, Trentino, leg. Burgeff (SMNS)]
Pales processioneae (Ratzeburg, 1840) [*opulenta* Herting; misid. as *P. pavida* by Herting 1960; prb. misid. as *P. pavida* by Frilli & Pizzaghi 1975; prb. misid. as *P. pumicata* by Cecconi 1924]	***Thaumetopoea processionea*** (Thaumetopoeidae): Cecconi 1924; Herting 1960 [Wachtl, s. Tschorsnig & Herting 2005]; Frilli & Pizzaghi 1975; IOBC-List 11; Cerretti 2005
Cyzenis albicans (Fallén, 1810)	***Operophtera brumata*** (Geometridae): Luciano & Roversi 2001; New record: 2 ♀♀, Campania, Avellino prov., Mercogliano, em. 1.–2.IV.1941, det. CE (DEZA)
Ceromasia rubrifrons (Macquart, 1834)	***Tyria jacobaeae*** (Arctiidae): Herting 1960 [Delucchi, Toscana] ***Zygaena erythrus*** (Zygaenidae): Robertson & Shaw in prep.
Ocytata pallipes (Fallén, 1820) [*Rhacodineura antiqua* Meigen]	***Forficula auricularia*** (Forficulidae): Thompson 1928
Cadurcia casta (Rondani, 1861) [*Masicera*, *Lydella*; misid. as *Meigenia floralis* by Faggioli 1931, rev. Herting 1960]	***Choreutis nemorana*** (Choreutidae): Del Guercio 1900b; Cuscianna 1927; Faggioli 1931; New record: 1 ♂, Emilia-Romagna, Bologna, 3.VIII.1981, det. HE, CE (IEGG) ***Uresiphita gilvata*** (Crambidae): New record: 20 ♂♂, Campania, Naples prov., Ercolano, Resina, 21.–22.VII.1947, det. CE (DEZA) ***Tortrix viridana*** (Tortricidae): IOBC-List 11; New record: 1 ♂, 4 ♀♀ (e. p.), Campania, Naples prov., Portici, 20. and 25.VI.1917, det. CE (DEZA)
Eurysthaea scutellaris (Robineau-Desvoidy, 1848) [*Roeselia*, *Erythrocera*, *Discochaeta (h)yponomeutae* Rondani, *evonymellae* Ratzeburg]	***Eupithecia innotata*** (Geometridae): IOBC-List 14 ***Acleris forsskaleana*** (Tortricidae): Faggioli 1932 ***Tortrix viridana*** (Tortricidae): Silvestri 1923; New record: 2 ♂♂, 4 ♀♀ (e. p.), Campania, Naples prov., Portici, 11.VI.1912, 20. and 26.VI.1917, det. CE (DEZA) ***Yponomeuta cagnagella*** (Yponomeutidae): Rondani 1861 ***Yponomeuta malinellus*** (Yponomeutidae): Rondani 1873 (s. a. Rondani 1872a); New records: 2 ♀♀, Piemonte, Torino prov., Coazze, VII.1951, leg. G. Della Beffa, det. CE (MSNV); 3 ♂♂, 1 ♀, Campania, Naples prov., Caivano, 14. and 18.VI.1934, det. CE (DEZA) ***Yponomeuta padella*** (Yponomeutidae): Servadei 1930; Domenichini 1963; IOBC-List 8; Frilli & Pizzaghi 1975 ***Yponomeuta rorrella*** (Yponomeutidae): Roberti 1952 ***Yponomeuta*** sp. (Yponomeutidae): New records: 1 ♂, 2 ♀♀, Campania, Caserta prov., Sessa Aurunca, 1. and 3.VII.1936; 2 ♂♂, 2 ♀♀, Campania, Avellino prov., Monteforte superiore, 2.VII.1928 and 4.VII.1929, all det. CE (DEZA)
Elodia ambulatoria (Meigen, 1824)	***Morophaga choragella*** (Tineidae): Campadelli & Gardenghi 1989; IOBC-List 14

Elodia morio (Fallén, 1820) [*tragica* Meigen]	***Tortrix viridana*** (Tortricidae): Delrio et al. 1988 (s. a. Luciano & Roversi 2001); IOBC-List 12; Reggiani et al. 2006; New record: 2 ♀♀, Sicilia, R. N. Bosco della Ficuzza, S. Barbara, 28.V.–11.VI.2004, leg. G. Lo Verde, det. TS ***Cydia pomonella*** (Tortricidae): Reggiani 2005 (s. a. Reggiani et al. 2006) ***Zeiraphera griseana*** (Tortricidae): Tschorsnig & Herting 2005 ***Zeiraphera rufimitrana*** (Tortricidae): Schedl 1963
Sturmia bella (Meigen, 1824) [*vanessae* R. D., *Masicera pupiphaga* Rondani; *Sturmia vanessae* of Zocchi 1957 is prb. misid.]	***Chrysodeixis chalcites*** (Noctuidae): Triggiani 1969 ***Aglais urticae*** (Nymphalidae): Faggioli 1932; Mellini 1957a; New record: 1 ♀, Lazio, Rieti prov., Torrente Neta, Collegentilesco, 1000 m, 15.VI.2002, leg. M. Lucarelli, det. CE (MZUR) ***Inachis io*** (Nymphalidae): Bezzi 1892; Mellini 1957a; New record: 2 ♂♂, Piemonte, Torino prov., Canavesano, Valprato Soana, leg. G. Della Beffa, det. CE (MSNV) ***Nymphalis antiopa*** (Nymphalidae): IOBC-List 14 ***Nymphalis polychloros*** (Nymphalidae): Mellini 1957a ***Nymphalis vaualbum*** (Nymphalidae): Rondani 1877 ***Vanessa cardui*** (Nymphalidae): New record: 1 ♀ (e. l.), Lazio, Roma, Parco Esp. Univ., 16.VI.1943, leg. Hartig, det. CE (MZUR) ***Pieris brassicae*** (Pieridae): IOBC-List 14 ***Galleria mellonella*** (Pyralidae): Campadelli 1975 [laboratory] [***Lozotaeniodes cupressana*** (Tortricidae): Zocchi 1957]
Blepharipa pratensis (Meigen, 1824) [*Sturmia*, *scutellata* Robineau-Desvoidy; the material of Hellrigl 1997 was identified with "?"]	***Malacosoma neustria*** (Lasiocampidae): Delrio et al. 1983; Luciano & Roversi 2001; Dindo et al. 2002 ***Lymantria dispar*** (Lymantriidae): Burgess & Crossman 1929; Delrio et al. 1979 (s. a. Luciano & Prota 1982a, Luciano & Prota 1982b); Luciano & Prota 1983; Luciano & Prota 1985; Luciano & Prota 1986; Hellrigl 1997 (s. a. Hellrigl 2004); Dindo et al. 2002; Cerboneschi 2004; Camerini 2009
Masicera pavoniae (Robineau-Desvoidy, 1830) [*pratensis* Meigen; misid. as *Masicera silvatica* by Martelli 1911 – the eggs described by Martelli must belong to a second species, prb. *Exorista grandis*; misid. as *M. sylvatica* by Faggioli 1932, rev. HE; prb. misid. as *M. sylvatica* by Rondani 1861 and Bezzi 1893]	***Saturnia pavonia*** (Saturniidae): Martelli 1911; Herting 1960 [Trentino, IV.1927, leg. Schneider (SMNS)] ***Saturnia pyri*** (Saturniidae): Rondani 1861; Bezzi 1893; Faggioli 1932; Faggioli 1934; Baronio 1970; Frilli & Pizzaghi 1975; IOBC-List 13; New records: 1 ♀, Friuli-Venezia Giulia, Trieste, coll. Engel, det. TS (SMNS); 1 ♀, Liguria, La Spezia prov., Ameglia, VII.1902, leg. C. Fiori, det. CE (MSNG)
Masicera silvatica (Fallén, 1810) [questionable if it was really *silvatica*]	***Galleria mellonella*** (Pyralidae): Campadelli & Baronio 1978 [laboratory]
Masicera sphingivora (Robineau-Desvoidy, 1830) [*cuculliae* Robineau-Desvoidy; prb. misid. as *Tachina silvatica* or *Masicera sylvatica* by Brischke 1885, Rondani 1873, Howard & Fiske 1911, Martelli & Arru 1958, and Prota 1974]	***Malacosoma neustria*** (Lasiocampidae): Martelli & Arru 1958; Prota 1974; Delrio et al. 1979; Delrio et al. 1983; Luciano & Roversi 2001 ***Euproctis chrysorrhoea*** (Lymantriidae): Howard & Fiske 1911; New record: 1 ♀, Calabria, Cosenza prov., San Giovanni in Fiore, 5.VII.1941, det. CE (DEZA) ***Leucoma salicis*** (Lymantriidae): Rondani 1873; New record: 4 ♂♂, 19 ♀♀, Piemonte, Torino prov., Torrente Stura di Lanzo, VI.1953, leg. G. Della Beffa, det. CE (MSNV) ***Lymantria dispar*** (Lymantriidae): Prota 1974 ***Apopestes spectrum*** (Noctuidae): Brischke 1885; New record: 12 ♂♂, 15 ♀♀, Roma, Monte Sacro, em. 24.VI.–14.VII.1939, leg. Hartig, det. CE (MZUR) ***Sesamia nonagrioides*** (Noctuidae): Prota 1974 (s. a. IOBC-List 8) ***Shargacucullia lychnitis*** (Noctuidae): Prota 1974 ***Nymphalis polychloros*** (Nymphalidae): IOBC-List 14 ***Hyles dahlii*** (Sphingidae): Herting 1960; IOBC-List 10; Tschorsnig 1990 ***Hyles euphorbiae*** (Sphingidae): IOBC-List 11; New records: 3 ♂♂, 10 ♀♀, Piemonte, Torino prov., Val Chisone, Fenestrelle, 1150 m, VIII.1928, leg. G. Della Beffa, det. CE (MSNV); 2 ♀♀ (e. l.), Sicilia, Catania prov., Monte Etna southern slope, Pedara, 600 m, em. 3.IX.1949, leg. Hartig, det. CE (MZUR) ***Hyles vespertilio*** (Sphingidae): Herting 1960 [1 ♂, 2 ♀♀, Bozen, leg. Böttcher, teste TS (SMFD)]; New record: 1 ♀, Trentino-Alto Adige, Bolzano prov., Val Venosta, Val Martello (= Martell-Tal) near Morter, 12.VI.1971, leg. E. Friedrich, det. TS (SMNS) ***Zygaena erythrus*** (Zygaenidae): Robertson & Shaw in prep.

Dolichocolon paradoxum Brauer & Bergenstamm, 1889	***Mythimna unipuncta*** (Noctuidae): handwritten note of HE ("Mellini, Maccarese"), confirmed by CE (2 ♂♂, e. p., Lazio, Roma prov., Maccarese, 3.X.1971, IEGG)
Palesisa nudioculata Villeneuve, 1929	**Lepidoptera** gen. sp.: Cerretti 2001a
Prosopea nigricans (Egger, 1861) [*Prosopaea*, *Frontina instabilis* Rondani]	***Eilema*** sp. (Arctiidae): handwritten note of HE ("Mellini") ***Tyria jacobaeae*** (Arctiidae): Rondani 1877 ***Galleria mellonella*** (Pyralidae): Campadelli & Baronio 1978 [laboratory]
Gonia bimaculata Wiedemann, 1819	***Agrotis ipsilon*** (Noctuidae): IOBC-List 11 ***Agrotis*** sp. (Noctuidae): New record: 1 ♀, Calabria, Reggio Calabria prov., Sant'Eufemia d'Aspromonte, 23.VI.1942, on Barbabietola, det. CE (DEZA)
Gonia ornata Meigen, 1826 [the material from *Agrotis* must be revised, because it can easily belong to a different species of *Gonia*]	***Agrotis exclamationis*** (Noctuidae): Menozzi 1947 ***Agrotis ipsilon*** (Noctuidae): Del Guercio 1900a ***Lycia florentina*** (Geometridae): handwritten note of HE ("Mellini") [1 puparium in SMNS]
Pseudogonia parisiaca (Robineau-Desvoidy, 1851) [*Gonia cognata* Rondani]	***Hyphantria cunea*** (Arctiidae): IOBC-List 13 ***Phragmatobia fuliginosa*** (Arctiidae): handwritten note of HE ("Mellini"); New records: 1 ♂ (e. p.), Calabria, Cosenza prov., Belvedere Marittimo, larva collected 21.IV., em. 31.V.1950, det. CE (MZUR); 2 ♀♀, Sicilia, Catania prov., Monte Etna western slope, Alb. Serra la Nave, 1700 m, host collected 28.III.1950, em. 15.V.1950, leg. Hartig, det. CE (MZUR) ***Spilosoma luteum*** (Arctiidae): Mellini 1963 ***Tyria jacobaeae*** (Arctiidae): Herting 1960
Pseudogonia rufifrons (Wiedemann, 1830) [*Gonia cinerascens*]	***Ostrinia nubilalis*** (Crambidae): Campadelli 1981; Baronio et al. 2002 [all laboratory] ***Mamestra brassicae*** (Noctuidae): Baronio & Sehnal 1980; Campadelli 1981 [all laboratory] ***Mythimna unipuncta*** (Noctuidae): Campadelli 1981 [laboratory] ***Sesamia nonagrioides*** (Noctuidae): Campadelli 1981 [laboratory] ***Tyta luctuosa*** (Noctuidae): Rosenthal et al. 1988 ***Galleria mellonella*** (Pyralidae): Baronio & Campadelli 1978; Campadelli & Baronio 1978; Mellini et al. 1978; Mellini et al. 1979a; Mellini et al. 1979b; Baronio & Sehnal 1980; Campadelli 1980; Mellini & Campadelli 1980; Mellini & Gironi 1980; Baronio et al. 1981; Mellini & Gironi 1981; Mellini & Campadelli 1982; Mellini & Cesari 1982; Mellini & Dindo 1982; Campadelli 1983; Dindo 1983; Mellini & Beccari 1983; Mellini & Boninsegni 1983; Mellini & Braga 1983; Mellini & Bratti 1983; Bratti 1985; Campadelli & Tosi 1985; Mellini et al. 1985; Dindo 1986; Mellini & Campadelli 1986; Mellini et al. 1986; Campadelli 1987; Dindo 1987; Campadelli & Fanti 1988; Dindo 1989; Campadelli & Zanotti 1990; Mellini & Borgatti 1992; Baronio et al. 2002 [all laboratory; Mellini & Coulibaly 1991 give a compendium on the research of this complex and cite more papers]
Spallanzania hebes (Fallén, 1820) [*Cnephalia*; identification to species level not yet confirmed; "*Chetolyga pilifera*? Rdn." of Del Guercio 1900a may – according to fig. 20 – also belong to *Spallanzania*]	***Phragmatobia fuliginosa*** (Arctiidae): Menozzi 1947 ***Agrotis ipsilon*** (Noctuidae): Del Guercio 1900a ***Helicoverpa armigera*** (Noctuidae): New record: 5 ♂♂ (e. p.), Friuli-Venezia Giulia, Udine, Torrente Torre, XI.2007, leg. E. Cargnus, det. E. Cargnus and CE (CEC)
Spallanzania multisetosa (Rondani, 1859)	***Diaphora sordida*** (Arctiidae): Mückstein et al. 2007
Tachina fera (Linnaeus, 1761)	***Sesamia cretica*** (Noctuidae): handwritten note of HE ("Baronio, Romagna")
Tachina grossa (Linnaeus, 1758) [*Echinomyia*]	***Lasiocampa quercus*** (Lasiocampidae): Rondani 1877 [not marked by Rondani as "obs. n.", but might be an original record because obviously no older records of this host-parasitoid couple are known]
Tachina magnicornis (Zetterstedt, 1844) [*Echinomyia*, *conjugata* Rondani]	***Lymantria dispar*** (Lymantriidae): Rondani 1877 ***Agrotis ipsilon*** (Noctuidae): Menozzi 1947 ***Agrotis segetum*** (Noctuidae): Menozzi 1930 (s. a. Menozzi 1947) ***Galleria mellonella*** (Pyralidae): Campadelli & Baronio 1978 [laboratory]

Tachina praeceps Meigen, 1824 [*Echinomyia*]	***Tyria jacobaeae*** (Arctiidae): New record: 1 ♀ (e. l.), Sicilia, Catania prov., Monte Etna western slope, Pineta, 1600 m, em. IX.1948, leg. HARTIG, det. CE (MZUR) ***Macrothylacia rubi*** (Lasiocampidae): IOBC-List 14 ***Malacosoma franconicum*** (Lasiocampidae): HERTING 1960 ***Malacosoma neustria*** (Lasiocampidae): IOBC-List 11 ***Euproctis chrysorrhoea*** (Lymantriidae): RONDANI 1877 (s. a. RONDANI 1878); handwritten note of HE ("Bologna"); New records: 3 ♂♂, Piemonte, Torino-Venaria, Mandria, VII.1950, leg. G. DELLA BEFFA, det. CE (MSNV); 1 ♂, Lazio, Frosinone prov., Monte la Meta, Colle Alto, 1000 m, 28.VIII.1940, leg. C. N. R., det. CE (MZUR); 1 ♂, 2 ♀♀, Calabria, Cosenza prov., San Giovanni in Fiore, 29.VI.–5.VII.1941, det. CE (DEZA) ***Spodoptera exigua*** (Noctuidae): handwritten note of HE ("MELLINI") ***Hemaris tityus*** (Sphingidae): New record: 3 ♂♂, Trentino-Alto Adige, Bolzano prov., Nova Levante (= Welschenofen), 19. and 21.V.1988, leg. K. NIMMERFROH, det. TS (SMNS)
Peleteria abdominalis Robineau-Desvoidy, 1830	***Lasiocampa trifolii*** (Lasiocampidae): RONDANI 1877 (s. a. RONDANI 1878)
Peleteria rubescens (Robineau-Desvoidy, 1830) [fig. 19 of "*Echinomyia conjuncta* Rdn." in DEL GUERCIO 1900a resembles *P. rubescens*]	***Agrotis ipsilon*** (Noctuidae): DEL GUERCIO 1900a
Nemoraea pellucida (Meigen, 1824)	***Arctia caja*** (Arctiidae): New record: 3 ♀♀, Emilia-Romagna, Bologna, Boschi di Baricella, 24.VI.1961, leg. ALBERTONI, det. CE (IEGG) ***Hyphantria cunea*** (Arctiidae): TIBERI & BIN 1987; NANNI et al. 1989 (s. a. NANNI 1991); IOBC-List 12; MARCHESINI et al. 1998; CAMERINI & GROPPALI 1999 ***Phragmatobia fuliginosa*** (Arctiidae): TSCHORSNIG 1997b ***Spilosoma luteum*** (Arctiidae): MELLINI 1963 ***Axylia putris*** (Noctuidae): SANNINO et al. 2001 (s. a. IOBC-List 13) ***Helicoverpa armigera*** (Noctuidae): New record: 2 ♂♂, 1 ♀ (e. p.), Friuli-Venezia Giulia, Udine, Torrente Torre, IX.2007, leg. E. CARGNUS, det. E. CARGNUS and CE (CEC) ***Lacanobia oleracea*** (Noctuidae): CASTELLARI 1969; IOBC-List 11; SANNINO et al. 1993 ***Mamestra brassicae*** (Noctuidae): CASTELLARI 1969 ***Mythimna unipuncta*** (Noctuidae): IOBC-List 11; New record: 1 specimen (e. p.), Friuli-Venezia Giulia, Pordenone prov., San Quirino, 110 m, 11.X.2007, leg. G. GOVERNATORI, det. CE (CGG) ***Phlogophora meticulosa*** (Noctuidae): SANNINO et al. 2001 (s. a. IOBC-List 13) ***Proxenus hospes*** (Noctuidae): IOBC-List 11 ***Sesamia*** sp. (Noctuidae): New record: 1 ♂, [Italy, without locality], IV.1995, leg. A. RASPI, det. CE (CEAP) ***Galleria mellonella*** (Pyralidae): CAMPADELLI 1975; CAMPADELLI & BARONIO 1978 [all laboratory]
Linnaemya frater (Rondani, 1859)	***Amata phegea*** (Arctiidae): CERRETTI 2001b
Linnaemya lithosiophaga (Rondani, 1859) [*Micropalpus*; confirmed by HERTING 1969; misid. as "*musca larvarum*" by PASSERINI 1844 – this is the material which was described by RONDANI 1859]	***Eilema caniola*** (Arctiidae): RONDANI 1859 (s. a. PASSERINI 1844); New record: 4 ♂♂, 23 ♀♀, Lazio, Frosinone prov., Pontecorvo, 5.V. and 7.VII.1934, det. CE (DEZA) ***Eilema*** sp. (Arctiidae): handwritten note of HE ("MELLINI")
Linnaemya vulpina (Fallén, 1810) [*Linnaemyia*]	***Galleria mellonella*** (Pyralidae): CAMPADELLI & BARONIO 1978 [laboratory]
Chrysosomopsis aurata (Fallén, 1820) [*Chrysocosmius auratus*]	***Melanthia alaudaria*** (Geometridae): HERTING 1960
Lypha dubia (Fallén, 1810)	***Zeiraphera griseana*** (Tortricidae): HELLRIGL 1997 (s. a. HELLRIGL 2004)
Hyalurgus cruciger (Zetterstedt, 1838)	***Anoplonyx apicalis*** (Tenthredinidae): IOBC-List 13 (as *Anoplonyx* sp. in OBERPRANTACHER 1994) ***Anoplonyx ovatus*** (Tenthredinidae): IOBC-List 13 (s. a. OBERPRANTACHER 1994) ***Pachynematus imperfectus*** (Tenthredinidae): IOBC-List 13 (s. a. OBERPRANTACHER 1994) ***Pristiphora laricis*** (Tenthredinidae): IOBC-List 13 (s. a. OBERPRANTACHER 1994)

Hyalurgus lucidus (Meigen, 1824)	***Pristiphora erichsonii*** (Tenthredinidae): IOBC-List 13 (s. a. Oberprantacher 1994)
Cleonice callida (Meigen, 1824) [*Steiniella*]	***Chrysomela populi*** (Chrysomelidae): Mellini 1962b; Mellini 1962c [laboratory]; Albertoni 1963 [laboratory]; Mellini & Cucchi 1965; Mellini & Baronio 1971a [laboratory]; Mellini & Baronio 1972 [laboratory]
Loewia sp. (cf. *brevifrons* Rondani)	***Eupolybothrus fasciatus*** (Lithobiidae): New record: 2 puparia (flies not hatched because of ichneumonid hyperparasitism), Lazio, Latina prov., Sabaudia, V.1999, in remains of the host under bark of *Quercus robur*, leg. M. Mei, det. CE (CPC)
Pelatachina tibialis (Fallén, 1810)	[***Traumatocampa pityocampa*** (Thaumetopoeidae): Kramer 1917] [questionable record because the host is quite atypical]
Macquartia dispar (Fallén, 1820)	***Chrysolina americana*** (Chrysomelidae): Bibolini 1964; IOBC-List 14
Macquartia tenebricosa (Meigen, 1824) [*nitida* Zett.; Mellini's *M. chalconata* was probably studied by Herting because he treated it in his 1960 paper under *M. tenebricosa*; CE did not find any specimen of reared *M. chalconata* in IEGG, thus it is very probable that *M. chalconata* of Bibolini 1964, Mellini & Baronio 1971b and Baronio et al. 1973 also belong to *M. tenebricosa*]	***Chrysolina americana*** (Chrysomelidae): Bibolini 1964; IOBC-List 14 ***Chrysolina fastuosa*** (Chrysomelidae): Mellini 1958; New record: 1 ♂, 1 ♀, Emilia-Romagna, Bologna, Boschi di Baricella, 20.V.1961, leg. Albertoni, det. CE (IEGG) [***Chrysolina herbacea*** (Chrysomelidae): Mellini & Baronio 1971b [laboratory]; Baronio et al. 1973 [laboratory]] ***Chrysolina polita*** (Chrysomelidae): Albertoni 1963 [laboratory]
Macquartia tessellum (Meigen, 1824)	***Chrysolina americana*** (Chrysomelidae): New record: 5 ♂♂, 4 ♀♀ (e.l.), Campania, Naples prov., Portici, 19.XI.–20.XII.1934, det. CE (DEZA)
Anthomyiopsis plagioderae Mesnil, 1972 [misid. by Albertoni 1963 and Mellini 1971 as *Ptilopsina nigrisquamata*, and by Ruffo 1938, Lindner 1941 and Mellini 1957b as *P. nitens*; material of Mellini was seen by Mesnil 1944–1975]	***Plagiodera versicolora*** (Chrysomelidae): Ruffo 1938; Lindner 1941 [material in SMNS from Domodossola]; Mellini 1957b; Albertoni 1963 [laboratory]; Mellini 1971 [laboratory]
Triarthria setipennis (Fallén, 1810)	***Forficula auricularia*** (Forficulidae): Thompson 1928; Colombo & Fasce 1993 ***Forficula decipiens*** (Forficulidae): IOBC-List 12
Neoplectops pomonellae (Schnabl & Mokrzecki, 1903)	***Gypsonoma*** sp. (Tortricidae): Ford & Shaw 1991
Phytomyptera nigrina (Meigen, 1824) [*nitidiventris* Rondani, "*nitidiventris unicolor*" Rondani; it cannot be ruled out that some of the older material refers to a different species of *Phytomyptera*; the material from *Eupithecia* sp. was treated under *Phytomyptera cingulata* by Andersen 1988, but this is a clear error]	[***Eupithecia*** sp. (Geometridae): Andersen 1988 [1 ♂, 2 ♀♀, Liguria, 22.VIII.1965, leg. E. Jäckh (SMNS)]] [a geometrid host would be untypical for *Phytomyptera*, which is otherwise only known from Microlepidoptera] ***Adaina microdactyla*** (Pterophoridae): Mellini 1954a (s. a. Mellini 1954b, Mellini 1954d) ***Gypsonoma aceriana*** (Tortricidae): IOBC-List 10; New record: 1 ♂, Piemonte, Novara prov., Romagnano Sesia, 10.VII., coll. G. Della Beffa, det. CE (MSNV) ***Gypsonoma minutana*** (Tortricidae): Giunchi & De Giovanni 1987 ***Gypsonoma sociana*** (Tortricidae): Silvestri 1922; New record: 5 ♂♂, 3 ♀♀, Campania, Avellino, on *Corylus avellana*, 22.V.1916, 17.V.1917, and 5.VI.1917, det. CE (DEZA) ***Lobesia botrana*** (Tortricidae): Brauer & Bergenstamm 1894; Silvestri 1912; Catoni 1914; Nuzzaci & Triggiani 1982; Luciano et al. 1988; Marchesini & Dalla Montà 1992; Marchesini & Dalla Montà 1994 (s. a. Marchesini & Dalla Montà 1998, Marchesini 2007); Colombera et al. 2001 [host mixed with *Eupoecilia ambiguella* in this publication, but only *L. botrana* is cited in IOBC-List 14, based on the same record]; IOBC-List 14; Bagnoli & Lucchi 2006; Laccone 2007 ***Tortrix viridana*** (Tortricidae): Silvestri 1923; IOBC-List 12 ***Zelleria oleastrella*** (Yponomeutidae): Martelli 1916
Phytomyptera vaccinii Sintenis, 1897 [misid. as *Phytomiptera nigrina* by Puppini 1930, rev. HE]	***Recurvaria nanella*** (Gelechiidae): Puppini 1930

Actia crassicornis (Meigen, 1824) [*dubitata* Herting; identification of Faggioli 1937 confirmed by HE]	***Agonopterix alpigena*** (Depressariidae): New record: 2 ♂♂ (e. l.), Trentino-Alto Adige, Madonna di Campiglio, Pfeiffertafel, em. 13.VII.1937, leg. Hartig, det. CE (MZUR) ***Agonopterix subpropinquella*** (Depressariidae): Faggioli 1937 (s. a. Martelli 1954) ***Depressaria marcella*** (Depressariidae): handwritten note of HE ("Bologna") ***Depressaria*** sp. (Depressariidae): IOBC-List 10
Actia pilipennis (Fallén, 1810)	***Acleris hastiana*** (Tortricidae): New record: 1 ♂ (e. l.), Trentino-Alto Adige, Trento prov., Val Rendena, Pinzolo, 700 m, 2.IX.1935, ex coll. Hartig, det. CE (MZUR) ***Cacoecimorpha pronubana*** (Tortricidae): Colizza 1927; Winning 1938; Siscaro et al. 1988 (s. a. Siscaro & Longo 1988, Siscaro et al. 1989) ***Tortrix viridana*** (Tortricidae): Silvestri 1923, confirmed by CE (1 ♀ from Portici, 14.VI.1917, DEZA)
Actia resinellae (Schrank, 1781) [first record for Italy]	***Rhyacionia buoliana*** (Tortricidae): New record: 1 ♀, Piemonte, Torino prov., Val Chisone, Fenestrelle, 1150 m, 4.VIII.1928, leg. G. Della Beffa, det. CE (MSNV)
Peribaea apicalis Robineau-Desvoidy, 1863	***Nycteola siculana*** (Nolidae): Leipnitz & Tschorsnig 2005 ***Aplocera plagiata*** (Geometridae): Leipnitz & Tschorsnig 2005
Peribaea tibialis (Robineau-Desvoidy, 1851) [*Strobliomyia*; the material of Mellini 1962a was confirmed by Herting 1968; misid. by Rondani 1872b as *Triptocera exoleta* = prb. *P. tibialis*]	***Eilema complana*** (Arctiidae): Mellini 1962a ***Phragmatobia fuliginosa*** (Arctiidae): Mellini 1962a ***Cucullia formosa*** (Noctuidae): New record: 1 ♂ (e. l.), Friuli-Venezia Giulia, Trieste prov., Duino, Aurisina, Villaggio del Pescatore, 20 m, em. 10.IX.1997, leg. C. Morandini, det. CE (MFNB) ***Lacanobia oleracea*** (Noctuidae): Mellini 1962a ***Mythimna unipuncta*** (Noctuidae): handwritten note of HE ("Mellini, Maccarese"), confirmed by CE (9.IX.1971, IEGG) ***Phyllophila obliterata*** (Noctuidae): New record: 1 ♀ (e. l.), Veneto, Venezia prov., Caorle, Brussa, Valle Vecchia, 3 m, host collected 30.VIII.1998, em. 10.IX.1998, leg. C. Morandini, det. CE (MFNB) ***Polymixis flavicincta*** (Noctuidae): Rondani 1872b **Noctuidae** gen. sp.: New record: 1 ♀ (e. l.), Lazio, Roma prov., Riano, 1938, leg. Hartig, det. CE (MZUR)
Aphantorhaphopsis samarensis (Villeneuve, 1921)	***Lymantria dispar*** (Lymantriidae): Camerini 2009
Bithia demotica (Egger, 1861) [misid. as *B. modesta* by TS]	***Bembecia ichneumoniformis*** (Sesiidae): IOBC-List 14
Bithia sp. [identified by Brauer (see Brauer & Bergenstamm 1894: 571) as *Rhinotachina proletaria* Egger, but treated as identical with *R. modesta* by Stein]	**Sesiidae** gen. sp.: Stein 1924
Leskia aurea (Fallén, 1820)	***Paranthrene tabaniformis*** (Sesiidae): New record: 1 ♂, Emilia-Romagna, Bologna, (pioppo) [= *Populus*], 5.V.1968, det. CE (IEGG) ***Sesia apiformis*** (Sesiidae): Campadelli 1986 ***Synanthedon myopaeformis*** (Sesiidae): Dalla Montà 1985; Castellari 1987 ***Synanthedon myopaeformis typhiaeformis*** (Sesiidae): Lucchese 1938b (s. a. Lucchese 1938a) [***Cydia pomonella*** (Tortricidae): Sciarra 1915] [the true host was probably *Synanthedon myopaeformis typhiaeformis* because Lucchese 1938a showed in experiments that *Cydia pomonella* was not accepted as host by larvae of *Leskia aurea*]
Fischeria bicolor Robineau-Desvoidy, 1830	***Alophia combustella*** (Pyralidae): Rondani 1874 (s. a. Rondani 1877)
Clausicella suturata Rondani, 1859	***Euzophera bigella*** (Pyralidae): Reggiani et al. 2006
Melisoneura leucoptera (Meigen, 1824)	***Serica brunnea*** (Melolonthidae): Mesnil 1944–1975 [1 specimen in coll. Rondani in MZUF as *Serica* sp., host species identified by P. Audisio]

Billaea adelpha (Loew, 1873) [*subrotundata* Rondani]	***Aromia moschata*** (Cerambycidae): Campadelli 1986; handwritten note of HE ("Abruzzi, leg. Adlbauer") ***Lamia textor*** (Cerambycidae): IOBC-List 11
Billaea irrorata (Meigen, 1826)	***Oberea pedemontana*** (Cerambycidae): Campadelli & Baronio 1981; Baronio et al. 1988 (s. a. IOBC-List 11); IOBC-List 13 ***Saperda populnea*** (Cerambycidae): IOBC-List 11; Hellrigl 1994 (s. a. Hellrigl 1997); IOBC-List 14; New record: 1 ♂ (e. l.), Piemonte, Torino, Sangone, 26.I.1951, leg. F. Venturi, det. CE (FVCP)
Billaea maritima (Schiner, 1862)	***Cetonia aurata*** (Cetoniidae): Campadelli 1986 ***Potosia*** sp. (Cetoniidae): IOBC-List 11 **Cetoniidae** gen. sp.: Campadelli & Baronio 1981 ***Rhynchophorus ferrugineus*** (Curculionidae): Lo Verde & Massa 2007
Billaea triangulifera (Zetterstedt, 1844)	***Acanthocinus xanthoneurus*** (Cerambycidae): IOBC-List 10; IOBC-List 11; IOBC-List 14 ***Leiopus nebulosus*** (Cerambycidae): IOBC-List 12; IOBC-List 13 ***Morimus asper*** (Cerambycidae): IOBC-List 11 ***Rhagium*** sp. (Cerambycidae): IOBC-List 12 ***Saperda scalaris*** (Cerambycidae): Campadelli & Gardenghi 1990; IOBC-List 13 ***Saphanus piceus*** (Cerambycidae): IOBC-List 12 ***Tetropium gabrieli*** (Cerambycidae): Hellrigl 1985
Dinera ferina (Fallén, 1817)	***Helops coeruleus*** (Tenebrionidae): IOBC-List 12 ***Sinodendron cylindricum*** (Lucanidae): Campadelli 1989; IOBC-List 12
Zeuxia aberrans (Loew, 1847)	***Lixus juncii*** (Curculionidae): handwritten note of HE ("Mellini, Cesena")
Zeuxia cinerea Meigen, 1826 [identification confirmed by CE (Menozzi material in IEGG)]	***Conorhynchus mendicus*** (Curculionidae): Menozzi 1938; Menozzi 1939 (s. a. Menozzi 1947) ***Lixus juncii*** (Curculionidae): Menozzi 1930 (s. a. Menozzi 1947)
Zeuxia zernyi Mesnil, 1963	***Agapanthia sicula*** (Cerambycidae): IOBC-List 11
Blepharomyia pagana (Meigen, 1824)	***Operophtera brumata*** (Geometridae): Silvestri 1941; New record: 7 ♂♂, 5 ♀♀, Marche, Macerata prov., Acquacanina, 24.III.–4.IV.1942, det. CE (DEZA)
Ramonda spathulata (Fallén, 1820)	***Noctua comes*** (Noctuidae): Tschorsnig 1997b
Periscepsia carbonaria (Panzer, 1798)	***Euxoa temera*** (Noctuidae): Monaco et al. 1977
Voria ruralis (Fallén, 1810) [*ambigua*]	***Autographa gamma*** (Noctuidae): Silvestri 1911; Menozzi 1947; Zambelli 1960 ***Hecatera dysodea*** (Noctuidae): Zambelli 1960 ***Lacanobia oleracea*** (Noctuidae): Menozzi 1938 (s. a. Menozzi 1947) ***Panchrysia deaurata*** (Noctuidae): Herting 1960 [Nago, coll. Engel, in SMNS] ***Plusia*** sp. (Noctuidae): Frilli & Pizzaghi 1975
Cyrtophleba ruricola (Meigen, 1824) [prb. misid. as *Plagia trepida* by Brischke 1885]	***Apopestes spectrum*** (Noctuidae): Brischke 1885; Rondani 1872b; Baronio 1973a (s. a. Campadelli & Baronio 1981); New record: 2 ♂♂, 1 ♀, Lazio, Roma, Montesacro, em. 4.VII.1939, leg. Hartig, det. CE (MZUR)
Hyleorus elatus (Meigen, 1838)	***Euproctis*** sp. (Lymantriidae): New record: 3 ♂♂, Piemonte, Torino prov., Torrente Stura, 30.V.1918, leg. G. Della Beffa, det. CE (MSNV)
Thelaira nigripes (Fabricius, 1794)	***Phragmatobia fuliginosa*** (Arctiidae): handwritten note of HE ("Mellini") ***Spilosoma luteum*** (Arctiidae): Mellini 1963
Rondania cucullata Robineau-Desvoidy, 1850 [Menozzi 1938 (footnote on p. 129) notes that all his previous records of *R. dimidiata* actually refer to *R. cucullata*]	***Brachycerus undatus*** (Curculionidae): Menozzi 1930; Menozzi 1939 (s. a. Menozzi 1947) ***Conorhynchus mendicus*** (Curculionidae): Menozzi 1929 (s. a. Menozzi 1930); Ciampolini & Antonelli 1953; Menozzi 1936; Menozzi 1938; Menozzi 1939 (s. a. Menozzi 1947); Bongiovanni 1960

	Larinus cynarae (Curculionidae): Menozzi 1930; Menozzi 1936; Menozzi 1939 (s. a. Menozzi 1947) ***Larinus scolymi*** (Curculionidae): Menozzi 1931; Menozzi 1936; Menozzi 1939 (s. a. Menozzi 1947) ***Larinus*** sp. (Curculionidae): Menozzi 1939
Microsoma exiguum (Meigen, 1824) [*exigua*]	***Coniatus tamarisci*** (Curculionidae): IOBC-List 14 ***Sitona*** sp. (Curculionidae): Aeschlimann 1980 (s. a. Aeschlimann 1990)
Eugymnopeza braueri Townsend, 1933	***Blaps gibba*** (Tenebrionidae): Cerretti & Mei 2001
Clytiomya sola (Rondani, 1861) [*Clytiomyia*]	***Graphosoma*** sp. (Pentatomidae): Giangiuliani et al. 1991 (s. a. IOBC-List 12)
Ectophasia crassipennis (Fabricius, 1794)	***Graphosoma lineatum*** (Pentatomidae): IOBC-List 13 ***Graphosoma*** sp. (Pentatomidae): Giangiuliani et al. 1991 ***Nezara viridula*** (Pentatomidae): Colazza & Bin 1990 (s. a. Colazza et al. 1996); Giangiuliani et al. 1991 ***Palomena prasina*** (Pentatomidae): IOBC-List 14
Ectophasia oblonga (Robineau-Desvoidy, 1830)	***Lygaeus creticus*** (Lygaeidae): Anderson 1991 ***Rhaphigaster nebulosa*** (Pentatomidae): Giangiuliani et al. 1991 ***Spilostethus pandurus*** (Lygaeidae): Anderson 1991
Gymnosoma nitens Meigen, 1824	***Sciocoris helferi*** (Pentatomidae): Michalk 1940
Gymnosoma rotundatum (Linnaeus, 1758)	***Palomena prasina*** (Pentatomidae): IOBC-List 14
Gymnosoma siculum Dupuis & Genduso, 1981 [*sicula*; possibly a synonym of *G. rungsi* Mesnil, but the difficult genus *Gymnosoma* is not yet revised]	***Aelia rostrata*** (Pentatomidae): Dupuis & Genduso 1981
Elomya lateralis (Meigen, 1824)	***Lygaeus creticus*** (Lygaeidae): IOBC-List 12 ***Spilostethus pandurus*** (Lygaeidae): IOBC-List 12
Phasia aurigera (Egger, 1860)	***Palomena prasina*** (Pentatomidae): IOBC-List 14 ***Rhaphigaster nebulosa*** (Pentatomidae): New record: 1 ♀, Lazio, Roma prov., Manziana, Caldara, pupated 12.IV.2009, em. 3.V.2009, leg. M. Mei, det. CE (CPC)
Phasia subcoleoptrata (Linnaeus, 1767) [as *P. musciformis* Rondani]	***Aelia rostrata*** (Pentatomidae): Dupuis & Genduso 1981
Trichopoda pennipes (Fabricius, 1781) [accidentally introduced and established]	***Graphosoma lineatum*** (Pentatomidae): Colazza et al. 1996 ***Nezara viridula*** (Pentatomidae): Colazza & Bin 1990; Colazza et al. 1996; Salerno et al. 2002
Leucostoma crassum Kugler, 1966 [*crassa*]	***Lygaeus creticus*** (Lygaeidae): Anderson 1991 ***Lygaeus equestris*** (Lygaeidae): Anderson 1991 ***Spilostethus pandurus*** (Lygaeidae): Anderson 1991 ***Tropidothorax leucopterus*** (Lygaeidae): Anderson 1991

Further notes

Bezzi (1900) observed *Cleonice callida* [*Steinia protuberans*] on foliage of *Populus* and concluded that they are possibly parasitoids of *Chrysomela* [*Lina*] *populi* and/or *tremulae*, but in fact he did not rear material.

"*Micropalpus sophia* Mg." (a species of unknown identity) of Del Guercio (1900a), reared from *Agrotis ipsilon*, cannot be solved without the knowledge of the material (the wide frons and the sharp abdominal stripes of fig. 24 are untypical for *Linnaemya*).

Tuccimei (1911) recorded one specimen of "*Masicera pratensis* Meig" reared from *Vanessa cardui*, possibly a misidentification of *Sturmia bella*.

Cecconi (1924) reared "*Phryxe vulgaris*" from *Lymantria dispar* (farfalla dispari) and indet. Psychidae; both are most probably misidentifications.

Menozzi (1947) recorded *Oswaldia muscaria* (Fallén, 1810) as reared from larvae of *Blitophaga* [= *Aclypea*] *opaca* (Linnaeus, 1758) (Silphidae), most probably a wrong identification because *O. muscaria* is known as a parasitoid of Geometridae and Noctuidae. Unfortunately the material could not be found in IEGG.

ALBERTONI (1963) received dwarf-like puparia of *Cleonice callida* from *Plagiodera versicolora* in the laboratory only, so it is unlikely that the small *Plagiodera* larvae are normal hosts of *Cleonice*.

BRANDMAYR (1973) reared tachinid larvae from larvae of *Pterostichus* [= *Poecilus*] *koyi* (Germar, 1824) (Carabidae). He presumed that they belonged to *Zaira cinerea*, but there was no identification, and this tachinid, being a parasitoid of the adult stage, would be very untypical indeed.

ALMA & ARZONE (1994) and ALMA et al. (1997) recorded five species of Tachinidae as reared from several Noctuidae, but there was no correlation to the single host species.

HELLRIGL (1994) recorded *Pelatachina tibialis* as reared in numbers from *Saperda populnea*, but it is very likely that this record is either based on a misidentification of the tachinid or on a wrong association with the host.

HELLRIGL (1997) noted "*Rondania* sp. ?*dimidiata* (Meig) an *Brachyderes*". According to HELLRIGL's pers. comm. the tachinid was observed while it was trying to oviposit on *Brachyderes*; however, it was neither reared nor collected.

TSCHORSNIG (2001) collected two females of *Goniocera montium* (Villeneuve, 1921) on a nest with young larvae of *Malacosoma alpicolum* Staudinger, 1870 (Lasiocampidae), so the host is likely, but in fact the material was not reared.

4 Host-parasitoid list

Coleoptera

Carabidae

Carabus coriaceus Linnaeus, 1758: *Zaira cinerea*
Carabus morbillosus Fabricius, 1792: *Zaira cinerea*
Carabus solieri Dejean, 1826: *Zaira cinerea*
Carabus violaceus Linnaeus, 1758: *Zaira cinerea*
Zabrus tenebrioides (Goeze, 1777): *Zaira cinerea*

Cerambycidae

Acanthocinus xanthoneurus (Mulsant & Rey, 1852): *Billaea triangulifera*
Agapanthia sicula Ganglbauer, 1884: *Zeuxia zernyi*
Aromia moschata (Linnaeus, 1758): *Billaea adelpha*
Lamia textor (Linnaeus, 1758): *Billaea adelpha*
Leiopus nebulosus (Linnaeus, 1758): *Billaea triangulifera*
Morimus asper (Sulzer, 1776): *Billaea triangulifera*
Oberea pedemontana Chevrolat, 1856: *Billaea irrorata*
Rhagium sp.: *Billaea triangulifera*
Saperda populnea (Linnaeus, 1758): *Billaea irrorata*
Saperda scalaris (Linnaeus, 1758): *Billaea triangulifera*
Saphanus piceus (Laicharting, 1784): *Billaea triangulifera*
Tetropium gabrieli Weise, 1905: *Billaea triangulifera*

Cetoniidae

Cetonia aurata (Linnaeus, 1761): *Billaea maritima*
Potosia sp.: *Billaea maritima*
Cetoniidae gen. sp.: *Billaea maritima*

Chrysomelidae

Agelastica alni (Linnaeus, 1758): *Meigenia uncinata*, *Meigenia mutabilis*
Altica brevicollis Foudras, 1860: *Medina luctuosa*, *Meigenia uncinata*
Altica quercetorum Foudras, 1860 [*Haltica*]: *Medina luctuosa*
Alticinae gen. sp. [Halticinae]: *Medina luctuosa*
Chrysolina americana Linnaeus, 1758: *Meigenia dorsalis*, *Macquartia tessellum*, *Macquartia dispar*, *Macquartia tenebricosa*, *Meigenia mutabilis*
Chrysolina fastuosa (Scopoli, 1763) [*Chrysomela*]: *Macquartia tenebricosa*, *Meigenia mutabilis*
Chrysolina grossa (Fabricius, 1792) [*Chrysomela*]: *Policheta unicolor*
Chrysolina herbacea (Duftschmid, 1825) [*Chrysomela*]: *Meigenia mutabilis*, [*Macquartia tenebricosa*]
Chrysolina polita (Linnaeus, 1758): *Macquartia tenebricosa*
Chrysomela populi Linnaeus, 1758 [*Melasoma*]: *Cleonice callida*, *Meigenia simplex*, *Meigenia dorsalis*, *Meigenia mutabilis*
Chrysomela sp. [*Melasoma*]: *Meigenia mutabilis*, *Meigenia simplex*
Crioceris asparagi (Linnaeus, 1758): *Meigenia simplex*, *Meigenia mutabilis*
Hydrothassa marginella (Linnaeus, 1758): *Meigenia mutabilis*
Leptinotarsa decemlineata (Say, 1824): *Policheta unicolor*
Phratora laticollis (Suffrian, 1851) [*Phyllodecta*]: *Meigenia simplex*
Phratora vitellinae (Linnaeus, 1758) [*Phyllodecta*]: *Medina separata*
Phytodecta fornicata (Brüggemann, 1873): *Meigenia mutabilis*
Plagiodera versicolora (Laicharting, 1781) [*versicolor*]: *Anthomyiopsis plagioderae*, *Meigenia mutabilis*, *Medina* sp.
Plagiosterna aenea (Linnaeus, 1758) [*Melasoma*]: *Medina separata*
Xanthogaleruca luteola (Müller, 1766) [*Galerucella*, *Galleruca*, *xanthomelaena* Schrank, 1781)]: *Erynniopsis antennata*, *Medina collaris*

Coccinellidae

Hippodamia undecimnotata (Schneider, 1792) [*Semiadalia*]: *Medina separata*
Propylea quatuordecimpunctata (Linnaeus, 1758): *Medina* sp.
Psyllobora vigintiduopunctata (Linnaeus, 1758) [*Thea*]: *Medina separata*

Curculionidae

Brachycerus undatus Fabricius 1798: *Rondania cucullata*
Coniatus tamarisci (Fabricius, 1787): *Microsoma exiguum*
Conorhynchus mendicus (Gyllenhal, 1834) [*Cleonus*, *Temnorrhinus*]: *Rondania cucullata*, *Zeuxia cinerea*
Larinus cynarae (Fabricius, 1787): *Rondania cucullata*
Larinus scolymi (Olivier, 1807): *Rondania cucullata*
Larinus sp.: *Rondania cucullata*
Lixomorphus algirus (Linnaeus, 1758) [*Lixus*]: [*Exorista larvarum*]
Lixus juncii Boheman, 1835 [*junci*]: *Zeuxia aberrans*, *Zeuxia cinerea*
Neoglanis salviae (Schrank, 1789) [*Hypera*]: [*Bessa parallela*], [*Phryxe vulgaris*]
Rhynchophorus ferrugineus (Olivier, 1790): *Billaea maritima*
Sitona sp.: *Microsoma exiguum*

Lucanidae

Sinodendron cylindricum (Linnaeus, 1758): *Dinera ferina*

Melolonthidae

Serica brunnea (Linnaeus, 1758): *Melisoneura leucoptera*
Triodonta raymondi Perris, 1869: *Zaira cinerea*

Tenebrionidae

Blaps gibba Laporte de Castelnau, 1840: *Eugymnopeza braueri*
Helops coeruleus (Linnaeus, 1758): *Dinera ferina*

Dermaptera

Forficulidae

Forficula auricularia Linnaeus, 1758: *Triarthria setipennis*, *Ocytata pallipes*
Forficula decipiens Gené, 1832: *Triarthria setipennis*

Heteroptera

Lygaeidae

Lygaeus creticus Lucas, 1854: *Leucostoma crassum*, *Ectophasia oblonga*, *Elomya lateralis*
Lygaeus equestris (Linnaeus, 1758): *Leucostoma crassum*
Spilostethus pandurus (Scopoli, 1763) [*Lygaeus*]: *Leucostoma crassum*, *Ectophasia oblonga*, *Elomya lateralis*
Tropidothorax leucopterus (Goeze, 1778): *Leucostoma crassum*

Pentatomidae

Aelia rostrata Boheman, 1852: *Gymnosoma siculum*, *Phasia subcoleoptrata*
Graphosoma lineatum (Linnaeus, 1758): *Ectophasia crassipennis*, *Trichopoda pennipes*
Graphosoma sp.: *Clytiomya sola*, *Ectophasia crassipennis*
Nezara viridula (Linnaeus, 1758): *Trichopoda pennipes*, *Ectophasia crassipennis*
Palomena prasina (Linnaeus, 1761): *Ectophasia crassipennis*, *Gymnosoma rotundatum*, *Phasia aurigera*
Sciocoris helferi Fieber, 1851: *Gymnosoma nitens*
Rhaphigaster nebulosa (Poda, 1761) [*Rhaphygaster*]: *Phasia aurigera*, *Ectophasia oblonga*

Hymenoptera

Argidae

Arge ochropus (Gmelin, 1790) [*rosae* auct.]: *Vibrissina turrita*
Arge pagana (Panzer, 1798): *Vibrissina turrita*
Arge sp.: *Vibrissina turrita*

Diprionidae

Diprion pini (Linnaeus, 1758): *Diplostichus janitrix*, *Drino inconspicua*, *Drino gilva*, *Blondelia inclusa*, *Blondelia nigripes*
Diprion similis (Hartig, 1836): *Drino inconspicua*
Gilpinia frutetorum (Fabricius, 1793): *Blondelia inclusa*
Gilpinia pallida (Klug, 1812): *Drino inconspicua*
Gilpinia socia (Klug, 1812): *Drino inconspicua*, *Drino gilva*, *Diplostichus janitrix*, *Blondelia inclusa*
Neodiprion sertifer (Geoffroy, 1785) [*Lophyrus rufus* Latreille, 1807]: *Drino inconspicua*

Pamphiliidae

Acantholyda erythrocephala (Linnaeus, 1758): *Myxexoristops hertingi*, *Myxexoristops* sp.
Acantholyda posticalis (Matsumura, 1912): *Myxexoristops bonsdorffi*

Tenthredinidae

Anoplonyx apicalis (Brischke, 1883) [*duplex* auct.]: *Hyalurgus cruciger*
Anoplonyx ovatus (Zaddach, 1883): *Hyalurgus cruciger*
Athalia rosae (Linnaeus, 1758) [*colibri* Christ, 1791]: *Exorista mimula*, *Meigenia mutabilis*, *Blondelia nigripes*
Nematus melanaspis Hartig, 1840: *Bessa selecta*
Nematus pavidus Serville, 1823: *Bessa selecta*
Pachynematus imperfectus (Zaddach, 1876): *Hyalurgus cruciger*
Pristiphora erichsonii (Hartig, 1837): *Hyalurgus lucidus*, *Drino inconspicua*
Pristiphora laricis (Hartig, 1837): *Hyalurgus cruciger*

Lepidoptera

Arctiidae

Amata kruegeri (Ragusa, 1904) [*Syntomis marjana* (Stauder, 1913)]: *Carcelia falenaria*, *Tryphera lugubris*
Amata phegea (Linnaeus, 1758): *Linnaemya frater*
Amata sp.: *Carcelia falenaria*
Arctia caja (Linnaeus, 1758) [*Chelonia*]: *Carcelia lucorum*, *Hubneria affinis*, *Nemoraea pellucida*
Arctia flavia (Fuessly, 1779): *Carcelia alpestris*
Arctia villica (Linnaeus, 1758) [*Chelonia*, *konewkai* (Freyer, 1831)]: *Carcelia lucorum*
Arctia sp.: *Carcelia lucorum*
Coscinia cribraria (Linnaeus, 1758) [*Emydia coscinia*]: *Carcelia lucorum*
Cymbalophora pudica (Esper, 1785): *Carcelia lucorum*
Diaphora sordida (Hübner, 1803) [*Cycnia*]: *Spallanzania multisetosa*
Eilema caniola (Hübner, 1808) [*Lythosia*]: *Linnaemya lithosiophaga*
Eilema complana (Linnaeus, 1758) [*Lithosia*]: *Peribaea tibialis*
Eilema sp. [*Lithosia*]: *Linnaemya lithosiophaga*, *Prosopea nigricans*
Hyphantria cunea (Drury, 1773): *Compsilura concinnata*, *Exorista larvarum*, *Pales pavida*, *Nemoraea pellucida*, *Zenillia libatrix*, *Carcelia bombylans*, *Pseudogonia parisiaca*
Ocnogyna baetica (Rambur, 1836) [*baeticum*]: *Gymnophryxe carthaginiensis*
Lithosia quadra (Linnaeus, 1758): *Compsilura concinnata*
Phragmatobia fuliginosa (Linnaeus, 1758) [*Arctia*]: *Hubneria affinis*, *Carcelia lucorum*, *Exorista larvarum*, *Thelaira nigripes*, *Spallanzania hebes*, *Pseudogonia parisiaca*, *Pales pavida*, *Nemoraea pellucida*, *Peribaea tibialis*
Spilosoma luteum (Hufnagel, 1766) [*Spilarctia lubricipeda* auct. (nec. Linnaeus)]: *Thelaira nigripes*, *Exorista larvarum*, *Nemoraea pellucida*, *Pseudogonia parisiaca*
Tyria jacobaeae (Linnaeus, 1758) [*Euchelia*]: *Carcelia dubia*, *Ceromasia rubrifrons*, *Prosopea nigricans*, *Pseudogonia parisiaca*, *Tachina praeceps*
Arctiidae gen. sp.: *Carcelia bombylans*, *Exorista larvarum*

Choreutidae

Choreutis nemorana (Hübner, 1799) [*Simaethis*, *Hemerophila*]: *Cadurcia casta*

Cossidae

Cossus cossus (Linnaeus, 1758): *Xylotachina diluta*

Crambidae

Ostrinia nubilalis (Hübner, 1796) [*Pyrausta*]: *Lydella thompsoni*, *Pseudoperichaeta nigrolineata*, *Nemorilla maculosa*, *Pseudogonia rufifrons* [laboratory]

Palpita vitrealis (Rossi, 1794) [*Margaronia*, *Glyphodes unionalis* (Hübner, 1796)]: *Nemorilla maculosa*
Udea ferrugalis (Hübner, 1796): *Nemorilla maculosa*
Uresiphita gilvata (Fabricius, 1794) [*polygonalis* auct.]: *Nemorilla maculosa*, *Pseudoperichaeta nigrolineata*, *Cadurcia casta*

Danaidae

Danaus chrysippus (Linnaeus, 1758): *Compsilura concinnata*

Depressariidae

Agonopterix alpigena (Frey, 1870): *Actia crassicornis*
Agonopterix subpropinquella (Stainton, 1849) [*Depressaria*]: *Nemorilla maculosa*, *Actia crassicornis*
Depressaria marcella Rebel, 1901: *Nemorilla maculosa*, *Actia crassicornis*, *Pseudoperichaeta palesioidea*
Depressaria sp.: *Nemorilla maculosa*, *Actia crassicornis*

Gelechiidae

Recurvaria nanella (Denis & Schiffermüller, 1775): *Phytomyptera vaccinii*

Geometridae

Agriopis leucophaearia (Denis & Schiffermüller, 1775): *Smidtia conspersa*
Aplocera plagiata (Linnaeus, 1758): *Peribaea apicalis*
Athroolopha chrysitaria (Geyer, 1831): [*Chetina setigena*]
Colotois pennaria (Linnaeus, 1761): *Compsilura concinnata*, *Zenillia libatrix*
Ematurga atomaria (Linnaeus, 1758): *Phryxe magnicornis*
Eupithecia innotata (Hufnagel, 1767): *Eurysthaea scutellaris*
Eupithecia sp.: [*Phytomyptera nigrina*]
Lycia florentina (Stefanelli, 1882): *Phryxe vulgaris*, *Exorista civilis*, *Exorista larvarum*, *Gonia ornata*
Melanthia alaudaria (Freyer, 1846) [*Larentia*]: *Chrysosomopsis aurata*
Operophtera brumata (Linnaeus, 1758): *Cyzenis albicans*, *Phorocera obscura*, *Blondelia nigripes*, *Blepharomyia pagana*, [*Pales pavida*]
Pelurga comitata (Linnaeus, 1758): *Pales pavida*
Pseudoterpna pruinata (Hufnagel, 1767): *Ethilla aemula*
Geometridae gen. sp.: *Clemelis pullata*, *Pales pavida*, *Paratryphera bisetosa*, *Senometopia susurrans*

Hepialidae

Hepialus humuli (Linnaeus, 1758): *Compsilura concinnata*

Hesperiidae

Carcharodus sp. [cf. *alceae*]: *Thecocarcelia trichops*

Heterogynidae

Heterogynis penella (Hübner, 1819): *Phryxe hirta*

Lasiocampidae

Eriogaster catax (Linnaeus, 1758): *Blondelia nigripes*
Eriogaster lanestris (Linnaeus, 1758): *Compsilura concinnata*, *Pales pavida*
Gastropacha quercifolia (Linnaeus 1758): *Exorista larvarum*, *Compsilura concinnata*
Lasiocampa quercus (Linnaeus, 1758) [*Bombyx*]: *Tachina grossa*, *Pales pavida*
Lasiocampa trifolii (Denis & Schiffermüller, 1775) [*Bombyx*]: *Chetogena obliquata*, *Peleteria abdominalis*
Macrothylacia rubi (Linnaeus, 1758): *Tachina praeceps*
Malacosoma franconicum (Denis & Schiffermüller, 1775) [*franconica*]: *Tachina praeceps*, *Pales pavida*
Malacosoma neustria (Linnaeus, 1758) [*neustrium*]: *Pales pavida*, *Exorista larvarum*, *Masicera sphingivora*, *Tachina praeceps*, *Blepharipa pratensis*, [*Exorista fasciata*]

Lycaenidae

Cacyreus marshalli Butler, 1898: *Aplomya confinis*
Lampides boeticus (Linnaeus, 1767): *Pseudoperichaeta nigrolineata*
Lycaena dispar (Haworth, 1802): *Aplomya confinis*
Neozephyrus quercus (Linnaeus, 1758) [*Thecla*]: *Aplomya confinis*, *Phryxe nemea*
Satyrium ilicis (Esper, 1779) [*Thecla*]: *Aplomya confinis*
Scolitantides orion (Pallas, 1771): *Aplomya confinis*

Lymantriidae

Calliteara pudibunda (Linnaeus, 1758) [*Dasychira*]: *Carcelia rasa*, *Compsilura concinnata*, *Pales pavida*, *Exorista larvarum*
Euproctis chrysorrhoea (Linnaeus, 1758) [*Liparis*, *Lyparis*, *Portesia*]: *Townsendiellomyia nidicola*, *Carcelia laxifrons*, *Compsilura concinnata*, *Exorista larvarum*, *Pales pavida*, *Zenillia libatrix*, *Tachina praeceps*, *Blondelia nigripes*, *Masicera sphingivora*, *Exorista fasciata*, [*Nilea innoxia*]
Euproctis sp.: *Hyleorus elatus*
Leucoma salicis (Linnaeus, 1758) [*Liparis*]: *Exorista larvarum*, *Carcelia gnava*, *Masicera sphingivora*
Lymantria dispar (Linnaeus, 1758) [*Liparis*, *Porthetria*]: *Blepharipa pratensis*, *Exorista larvarum*, *Parasetigena silvestris*, *Compsilura concinnata*, *Senometopia separata*, *Drino inconspicua*, *Exorista segregata*, *Aphantorhaphopsis samarensis*, *Pales pavida*, *Tachina magnicornis*, *Masicera sphingivora*, [*Nilea innoxia*], [*Phryxe semicaudata*]
Lymantria monacha (Linnaeus, 1758): *Parasetigena silvestris*, *Exorista larvarum*
Orgyia antiqua (Linnaeus, 1758): *Compsilura concinnata*, *Exorista larvarum*
Orgyia dubia (Tauscher, 1806): *Pales pavida*
Orgyia rupestris Rambur, 1832: *Compsilura concinnata*

Noctuidae

Acronicta psi (Linnaeus, 1758) [*Acronycta*]: *Nilea hortulana*, *Eumea mitis*
Acronicta rumicis (Linnaeus, 1758) [*Apateles*]: *Compsilura concinnata*, *Nilea innoxia*, *Exorista larvarum*
Acronicta sp. [cf. *rumicis*]: *Exorista larvarum*
Agrotis exclamationis (Linnaeus, 1758): *Gonia ornata*
Agrotis ipsilon (Hufnagel, 1766): *Gonia bimaculata*, *Exorista larvarum*, *Spallanzania hebes*, *Peleteria rubescens*, *Gonia ornata*, *Tachina magnicornis*, *Phryxe vulgaris*
Agrotis segetum (Denis & Schiffermüller, 1775) [*Scotia*, *segetis* Hübner]: *Exorista larvarum*, *Tachina magnicornis*
Agrotis sp.: *Gonia bimaculata*
Apopestes spectrum (Esper, 1787) [*Noctua*, *Spintherops*]: *Cyrtophleba ruricola*, *Masicera sphingivora*
Autographa gamma (Linnaeus, 1758) [*Plusia*]: *Voria ruralis*, *Phryxe vulgaris*, *Pales pavida*, *Exorista larvarum*
Axylia putris (Linnaeus, 1761): *Exorista larvarum*, *Pales pavida*, *Nemoraea pellucida*
Brithys crini (Fabricius, 1775) [*pancratii* (Cyrillo, 1787)]: *Exorista xanthaspis*

Caradrina sp. [cf. *morpheus*]: *Pales pavida*
Chrysodeixis chalcites (Esper, 1789) [*Plusia*]: *Sturmia bella*
Cosmia trapezina (Linnaeus, 1758): *Blondelia nigripes*, *Phryxe nemea*, *Pales pavida*
Cucullia formosa Rogenhofer, 1860: *Peribaea tibialis*
Dryobotodes monochroma (Esper, 1790) [*Eumichtis*]: *Pales pavida*
Euxoa temera (Hübner, 1808): *Periscepsia carbonaria*
Gortyna xanthenes Germar, 1842: *Lydella stabulans*
Hecatera dysodea (Denis & Schiffermüller, 1775) [*Polia spinaciae* (Vieweg, 1790)]: *Voria ruralis*
Helicoverpa armigera (Hübner, 1808) [*Heliothis*, *armiger*]: *Exorista larvarum*, *Spallanzania hebes*, *Nemoraea pellucida*
Lacanobia oleracea (Linnaeus, 1758) [*Mamestra*, *Polia*]: *Pales pavida*, *Exorista larvarum*, *Nemoraea pellucida*, *Voria ruralis*, *Peribaea tibialis*, [*Exorista fasciata*]
Macdunnoughia confusa (Stephens, 1850): *Phryxe vulgaris*
Mamestra brassicae (Linnaeus, 1758) [*Barathra*]: *Compsilura concinnata*, *Exorista larvarum*, *Nemoraea pellucida*, [*Exorista fasciata*], *Pseudogonia rufifrons* [laboratory]
Mythimna unipuncta (Haworth, 1809): *Exorista larvarum*, *Nemoraea pellucida*, *Peribaea tibialis*, *Dolichocolon paradoxum*, *Blondelia nigripes*, *Pales pavida*, *Nemorilla maculosa*, *Pseudogonia rufifrons* [laboratory]
Noctua comes Hübner, 1813: *Ramonda spathulata*
Ochropleura leucogaster (Freyer, 1831): *Exorista larvarum*, *Pales pavida*
Orthosia cerasi (Fabricius, 1775) [*stabilis* (Denis & Schiffermüller, 1775)]: *Pales pavida*
Orthosia cruda (Denis & Schiffermüller 1775): *Phryxe nemea*
Panchrysia deaurata (Esper, 1787) [*Plusia*]: *Voria ruralis*
Peridroma saucia (Hübner, 1808): *Pales pavida*
Phlogophora meticulosa (Linnaeus, 1758): *Nemoraea pellucida*
Phyllophila obliterata (Rambur, 1833): *Peribaea tibialis*
Plusia sp.: *Voria ruralis*
Polymixis flavicincta (Denis & Schiffermüller, 1775) [*Polia*]: *Peribaea tibialis*
Proxenus hospes (Freyer, 1831) [*Athetis*, *Caradrina*]: *Blondelia nigripes*, *Nemoraea pellucida*, *Pales pavida*
Sesamia cretica Lederer, 1857: *Lydella thompsoni*, *Tachina fera*
Sesamia nonagrioides Lefèbvre, 1827: *Exorista segregata*, *Masicera sphingivora*, *Pseudogonia rufifrons* [laboratory]
Sesamia sp.: *Nemoraea pellucida*
Shargacucullia lychnitis (Rambur, 1833) [*Cucullia* "*lichnidis*"]: *Masicera sphingivora*
Shargacucullia prenanthis (Boisduval, 1840) [*Cucullia*]: *Pales pavida*
Spodoptera exigua (Hübner, 1808) [*Laphygma*]: *Pseudoperichaeta nigrolineata*, *Pseudoperichaeta palesioidea*, *Tachina praeceps*
Tyta luctuosa (Denis & Schiffermüller, 1775): *Pales pavida*, *Pseudogonia rufifrons*
Noctuidae gen. sp.: *Blondelia nigripes*, *Pales pavida*, *Peribaea tibialis*

Nolidae

Meganola togatulalis (Hübner, 1798): *Neophryxe vallina*
Nycteola asiatica (Krulikovsky, 1904): *Bessa parallela*, *Bactromyia aurulenta*, *Pseudoperichaeta nigrolineata*
Nycteola revayana (Scopoli, 1772) [*Sarrothripus*]: *Bessa parallela*, *Chetogena filipalpis*
Nycteola siculana (Fuchs, 1899): *Peribaea apicalis*

Notodontidae

Clostera pigra (Hufnagel, 1766): *Zenillia libatrix*
Phalera bucephala (Linnaeus, 1758): *Compsilura concinnata*, *Exorista larvarum*

Nymphalidae

Aglais urticae (Linnaeus, 1758) [*Vanessa*]: *Sturmia bella*, [*Exorista deligata*]
Euphydryas aurinia (Rottemburg, 1775): *Erycia furibunda*
Inachis io (Linnaeus, 1758) [*Vanessa*]: *Sturmia bella*, *Compsilura concinnata*, *Phryxe vulgaris*
Melitaea didyma (Esper, 1778): *Erycia fasciata*, *Exorista larvarum*
Nymphalis antiopa (Linnaeus, 1758) [*Vanessa*]: *Sturmia bella*, *Compsilura concinnata*, *Phryxe vulgaris*, *Exorista larvarum*
Nymphalis polychloros (Linnaeus, 1758): *Sturmia bella*, *Compsilura concinnata*, *Masicera sphingivora*
Nymphalis vaualbum (Denis & Schiffermüller, 1775) [*l-album*]: *Sturmia bella*
Vanessa cardui (Linnaeus, 1758): *Sturmia bella*

Papilionidae

Iphiclides podalirius (Linnaeus, 1758): *Compsilura concinnata*
Papilio machaon Linnaeus, 1758: *Buquetia musca*

Pieridae

Aporia crataegi (Linnaeus, 1758): *Phryxe vulgaris*, *Exorista segregata*, *Compsilura concinnata*
Pieris brassicae (Linnaeus, 1758) [*Mancipium*]: *Compsilura concinnata*, *Phryxe vulgaris*, *Exorista segregata*, *Sturmia bella*, *Pales pavida*
Pieris sp.: *Blondelia nigripes*

Psychidae

Apterona crenulella (Bruand, 1853): *Chetogena filipalpis*
Canephora hirsuta (Poda, 1761) [*unicolor* (Hufnagel, 1766)]: *Chetogena filipalpis*
Phalacropterix apiformis (Rossi, 1790) [*Phalacropteryx*]: *Chetogena filipalpis*, *Exorista larvarum*
Psyche crassiorella Bruand, 1851 [*Fumea*]: *Chetogena filipalpis*
Psychidae gen. sp.: *Exorista deligata*, *Chetogena filipalpis*

Pterophoridae

Adaina microdactyla (Hübner, 1813) [*Pterophorus microdactylus*]: *Phytomyptera nigrina*
Calyciphora nephelodactya (Eversmann, 1844) [*Aciptilia*]: *Ligeria angusticornis*

Pyralidae

Alophia combustella (Herrich-Schäffer, 1855) [*Ilithya palumbiella* Rondani, 1874]: *Fischeria bicolor*
Dioryctria abietella (Denis & Schiffermüller, 1775): *Pseudoperichaeta nigrolineata*
Euzophera bigella (Zeller, 1848) (Pyralidae): *Clausicella suturata*
Galleria mellonella (Linnaeus, 1758): *Pseudogonia rufifrons*, *Exorista larvarum*, *Masicera silvatica*, *Sturmia bella*, *Prosopea nigricans*, *Tachina magnicornis*, *Nemoraea pellucida*, *Linnaemya vulpina* [all laboratory]
Pyralidae gen. sp.: *Neophryxe vallina*

Saturniidae

Samia cynthia (Drury, 1773) [*Philosamia*]: *Pales pavida*
Saturnia pavonia (Linnaeus, 1758): *Masicera pavoniae*, *Compsilura concinnata*
Saturnia pyri (Denis & Schiffermüller, 1775) [*piri*]: *Masicera pavoniae*, *Exorista larvarum*

Sesiidae

Bembecia ichneumoniformis (Denis & Schiffermüller, 1775): *Bithia demotica*
Paranthrene tabaniformis (Rottemburg, 1775): *Leskia aurea*
Sesia apiformis (Clerck, 1759) [*Aegeria*]: *Leskia aurea*
Sesiidae gen. sp.: *Bithia* sp.
Synanthedon myopaeformis (Borkhausen, 1789) [*myopaeforme*]: *Leskia aurea*
Synanthedon myopaeformis typhiaeformis (Borkhausen, 1789) [*Aegeria*; *typhiaeformis* (as species)]: *Leskia aurea*

Sphingidae

Acherontia atropos (Linnaeus, 1758) [*Sphinx*, *Sphynx*]: *Drino atropivora*
Agrius convolvuli (Linnaeus, 1758): *Drino atropivora*
Hemaris tityus (Linnaeus, 1758): *Tachina praeceps*
Hyles dahlii (Geyer, 1828) [*Celerio*, *Deilephila*]: *Masicera sphingivora*
Hyles euphorbiae (Linnaeus, 1758) [*Celerio*]: *Masicera sphingivora*, *Exorista larvarum*
Hyles hippophaes (Esper, 1789): *Exorista grandis*
Hyles livornica (Esper, 1780): *Drino vicina*
Hyles vespertilio (Esper, 1780) [*Deilephila*]: *Masicera sphingivora*
Macroglossum stellatarum (Linnaeus, 1758) [*Macroglossa*]: *Exorista larvarum*
Smerinthus ocellatus (Linnaeus, 1758): *Exorista sorbillans*, *Nilea innoxia*
Sphinx ligustri Linnaeus, 1758: *Drino atropivora*
Sphinx pinastri Linnaeus, 1758 [*Hyloicus*]: *Phryxe erythrostoma*
Sphingidae gen. sp.: *Exorista sorbillans*

Thaumetopoeidae

Thaumetopoea processionea (Linnaeus, 1758) [*Cnetocampa*]: *Pales processioneae*, *Carcelia iliaca*, *Zenillia libatrix*, *Compsilura concinnata*, *Phryxe semicaudata*, *Exorista segregata*
Traumatocampa pityocampa (Denis & Schiffermüller, 1775) [*Thaumetopoea*]: *Phryxe caudata*, *Compsilura concinnata*, *Exorista segregata*, [*Townsendiellomyia nidicola*], [*Pelatachina tibialis*]

Tineidae

Morophaga choragella (Denis & Schiffermüller, 1775): *Elodia ambulatoria*

Tortricidae

Acleris forsskaleana (Linnaeus, 1758) [*Tortrix*, *forskaleana*]: *Eurysthaea scutellaris*
Acleris hastiana (Linnaeus, 1758) [*Acalla*]: *Actia pilipennis*
Archips podana (Scopoli, 1763): *Pseudoperichaeta nigrolineata*, *Nemorilla maculosa*
Archips rosana (Linnaeus, 1758) [*Cacoecia*]: *Pseudoperichaeta nigrolineata*, *Nemorilla maculosa*
Archips xylosteana (Linnaeus, 1758) [*Cacoecia*]: *Cestonia cineraria*
Argyrotaenia ljungiana (Thunberg, 1797) [*pulchellana* Haworth]: *Nemorilla maculosa*, *Bessa parallela*, *Pseudoperichaeta nigrolineata*, *Zenillia libatrix*
Cacoecimorpha pronubana (Hübner, 1799) [*Tortrix*]: *Actia pilipennis*, *Nemorilla maculosa*
Choristoneura lafauryana (Ragonot, 1875): *Nemorilla maculosa*, *Pseudoperichaeta nigrolineata*
Cnephasia chrysantheana (Duponchel, 1843): *Nemorilla maculosa*, *Pseudoperichaeta palesioidea*
Cydia pomonella (Linnaeus, 1758) [*Carpocapsa*]: *Elodia morio*, [*Leskia aurea*]
Cydia sp.: *Pseudoperichaeta nigrolineata*
Epichoristodes acerbella (Walker, 1864): *Nemorilla maculosa*
Grapholita funebrana Treitschke, 1835: *Pseudoperichaeta nigrolineata*
Gypsonoma aceriana (Duponchel, 1843): *Phytomyptera nigrina*
Gypsonoma minutana (Hübner, 1799): *Phytomyptera nigrina*
Gypsonoma sociana (Haworth, 1811) [*neglectana* Duponchel, 1844]: *Phytomyptera nigrina*
Gypsonoma sp.: *Neoplectops pomonellae*
Hedya nubiferana (Haworth, 1811): *Pseudoperichaeta nigrolineata*
Laspeyresia molesta (Busck, 1916) [*Cydia*]: *Bessa parallela*
Lobesia botrana (Denis & Schiffermüller, 1775) [*Eudemis*, *Polychrosis*]: *Phytomyptera nigrina*
Lozotaeniodes cupressana (Duponchel, 1836) [*Eulia*]: [*Sturmia bella*]
Pandemis cerasana (Hübner, 1786): *Pseudoperichaeta nigrolineata*, *Zenillia libatrix*
Pandemis dumetana (Treitschke, 1835): *Nemorilla maculosa*
Pandemis sp.: *Pseudoperichaeta nigrolineata*
Rhopobota naevana (Hübner, 1817): *Nemorilla maculosa*
Rhyacionia buoliana (Denis & Schiffermüller, 1775) [*Evetria*]: *Pseudoperichaeta nigrolineata*, *Actia resinellae*
Tortrix viridana Linnaeus, 1758: *Actia pilipennis*, *Elodia morio*, *Pseudoperichaeta nigrolineata*, *Nemorilla maculosa*, *Blondelia nigripes*, *Eurysthaea scutellaris*, *Compsilura concinnata*, *Phryxe nemea*, *Pales pavida*, *Phytomyptera nigrina*, *Cadurcia casta*
Zeiraphera griseana (Hübner, 1799) [*Semasia diniana* (Guenée, 1845)]: *Lypha dubia*, *Elodia morio*, *Nemorilla maculosa*, *Bessa parallela*
Zeiraphera rufimitrana (Herrich-Schäffer, 1851) [*Semasia*]: *Elodia morio*, *Nemorilla maculosa*
Tortricidae gen. sp.: *Nemorilla maculosa*

Yponomeutidae

Yponomeuta cagnagella (Hübner, 1813) [*Hyponomeuta cognatella* (*cognatellus*) (Hübner, 1825)]: *Bessa parallela*, *Eurysthaea scutellaris*, *Zenillia dolosa*
Yponomeuta evonymella (Linnaeus, 1758): *Bessa parallela*
Yponomeuta malinellus (Zeller, 1838) [*malinella*]: *Eurysthaea scutellaris*, *Bessa parallela*, *Compsilura concinnata*
Yponomeuta padella (Linnaeus, 1758) [*Hyponomeuta*, *padellus*]: *Bessa parallela*, *Eurysthaea scutellaris*, *Bactromyia aurulenta*, *Zenillia dolosa*
Yponomeuta rorrella (Hübner, 1796) [*Hyponomeuta*, *rorellus*]: *Bessa parallela*, *Eurysthaea scutellaris*
Yponomeuta sedella Treitschke, 1832 [*Hyponomeuta vigintipunctata* (Retzius, 1783)]: *Nemorilla maculosa*
Yponomeuta sp.: *Bessa parallela*, *Eurysthaea scutellaris*
Zelleria oleastrella (Millière, 1864): *Phytomyptera nigrina*

Zygaenidae

Theresimima ampellophaga (Bayle-Barelle, 1808) [*ampelophaga*]: *Zenillia libatrix*, *Exorista* sp.
Zygaena erythrus (Hübner, 1806): *Alsomyia capillata*, *Exorista nova*, *Ceromasia rubrifrons*, *Masicera sphingivora*
Zygaena lonicerae (Scheven, 1777): *Pales pavida*
Zygaena orana Duponchel, 1835: *Exorista segregata*
Zygaena rubicundus (Hübner, 1817) [*rubicunda*]: *Alsomyia capillata*
Zygaena transalpina (Esper, 1780): *Phryxe setifacies*, *Phryxe magnicornis*
Zygaena sp.: *Alsomyia capillata*

Lepidoptera gen. sp.

Senometopia susurrans, *Palesisa nudioculata*

Lithobiomorpha

Lithobiidae

Eupolybothrus fasciatus (Newport, 1845): *Loewia* sp.

Orthoptera

Acrididae

Anacridium aegyptium (Linnaeus, 1764) [*Acridium lineola*]: *Metacemyia calloti*

Phasmatodea

Phylliidae

Clonopsis gallica (Charpentier, 1825): *Thrixion aberrans*

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Centrodraco atrifilum, a new deepwater dragonet species from eastern Australia (Teleostei: Draconettidae)

Ronald Fricke

Abstract

The new deepwater dragonet *Centrodraco atrifilum* **n. sp.** from eastern Australia is characterised by its 13–14 rays in the second dorsal fin, 12–13 rays in the anal fin, the first dorsal fin with the second spine elongate and filamentous in both sexes, the second dorsal fin without filaments in the male, and the male body colour pattern: dorsally with three pairs of vertical dark brown streaks, followed by a single saddle below the end of the second dorsal fin and on the caudal peduncle. A key to the genera and species of Draconettidae is presented.

Keywords: Fishes, deepwater dragonets, Draconettidae, Australia, New South Wales, Queensland, new species, identification key.

Zusammenfassung

Die neue Tiefseeleierfischart *Centrodraco atrifilum* **n. sp.** aus Ostaustralien ist durch 13–14 Strahlen in der zweiten Rückenflosse, 12–13 Afterflossenstrahlen, einen stark verlängerten und filamentösen zweiten Stachelstrahl der ersten Rückenflosse, die nicht filamentösen Strahlen der zweiten Rückenflosse beim männlichen Exemplar, und die Körperfärbung des männlichen Exemplars mit einer dorsalen Reihe von drei Paaren vertikaler dunkler Bänder, gefolgt von einem Sattelfleck unter dem Ende der zweiten Rückenflosse und auf dem Schwanzstiel. Ein Bestimmungsschlüssel der Gattungen und Arten der Draconettidae wird aufgestellt.

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1 Introduction

Deepwater dragonets of the family Draconettidae are a small group of benthic living fishes occurring on soft bottoms of the continental edges and slopes and on submarine ridges and seamounts. Its species are distributed worldwide in tropical and subtropical areas, roughly between 35°N and 35°S. Most of the draconettids are considered to be extremely rare; many species are known only from a few specimens.

Draconettid fishes are characterised by an elongate, rounded body; a pointed snout; very large eyes; a protractile upper jaw; teeth in jaws villiform; the opercle and subopercle with a strong, simple spine each; gill opening wide; lateral line present, grooved; two dorsal fins, the first with three spines, the second with 12–14 unbranched rays (the last ray divided at its base); anal fin with 12–13 branched rays (the last ray divided at its base), pectoral fin large, rounded; pelvic fin with one spine and five rays; caudal fin truncate. The Draconettidae are distinguished from the similar Callionymidae by the lack of a preopercular spine, but the presence of an opercular and subopercular spine, the wide gill opening (restricted to a small pore in callionymids), and the grooved lateral line (covered by skin in callionymids, with small pores).

The family was first revised by Briggs & Berry (1959), who considered only a single genus as valid, and then by Nakabo (1982) who treated two genera and seven species. The most recent revision of Fricke (1992) included 11 valid species in two genera, *Centrodraco* Regan, 1913 and *Draconetta* Jordan & Fowler, 1903. Fricke (2002a) described a new species, *Centrodraco abstractum*, from the Philippines The checklist of Fricke (2002b) therefore included 12 valid species of the family.

The genus *Centrodraco* is characterised within the family Draconettidae by stout and pungent spines in the first dorsal fin (versus long and slender spines in *Draconetta*), usually 14 (13–15) soft rays in the second dorsal fin (versus 12 rays), usually 13 (12–14) soft rays in the anal fin (versus 12 rays), the disconnected lateral line (versus single, running to caudal peduncle), and the absent supratemporal lateral line canal (versus present) (Fricke 1992: 169–170).

Two small draconettid specimens, trawled off eastern Australia, turned out to belong to an undescribed species of *Centrodraco*. They are described and illustrated in the present paper.

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2 Methods and Materials

Methods follow Fricke (1992); fin-ray counts follow Fricke (1983). The classification follows Eschmeyer & Fricke (2009).

The starting point for length measurements is the mid of the upper lip. The predorsal (1) length is measured from the mid of the upper lip to the base of the first spine of the first dorsal fin; the predorsal (2) length correspondingly to the base of the first ray of the second dorsal fin. The last ray of the second dorsal and anal fins is always divided at its base; counts in the key include this divided ray as one.

In the description, the data for the holotype are given first, followed by the data for the paratype, in parentheses.

The following abbreviations are used in the text:

A	anal fin counts
AEST	Australian Eastern Standard Time
C & S	cleared and stained specimen
D	dorsal fin counts
FRV	fishery research vessel
P_1	pectoral fin counts
P_2	pelvic fin counts
RV	research vessel
SL	standard length

Species are classified based on Fricke (2002b); however, subspecies of *Centrodraco oregonus* are now raised to species level following the method of Fricke et al. (2009: 5).

Materials used for this paper are deposited in: The Australian Museum, Sydney, Australia (AMS); The Natural History Museum, London, U.K. (BMNH); Bernice P. Bishop Museum, Honolulu, Hawai'i, U.S.A. (BPBM); Department of Natural Science, Faculty of Science, Kochi University, Kochi, Japan (BSKU); California Academy of Sciences, San Francisco, U.S.A. (CAS); Laboratory of Marine Zoology, Graduate School of Fisheries Science, Hokkaido University, Hakodate, Japan (HUMZ); Institute of Oceanology, Russian Academy of Sciences, Moscow, Russia (IOAN); Museum of Comparative Zoology, Harvard College, Cambridge, Massachusetts, U.S.A. (MCZ); Museo Municipal do Funchal, Madeira, Portugal (MMF); South African Institute of Aquatic Biodiversity, Grahamstown, South Africa (SAIAB); Staatliches Museum für Naturkunde, Stuttgart, Germany (SMNS); Stanford University Collection in the California Academy of Sciences, San Francisco, U.S.A. (SU); University of British Columbia, Vancouver, Canada (UBC); Florida Museum of Natural History, Gainesville, Florida, U.S.A. (UF); National Museum of Natural History, Smithsonian Institution, Washington D.C., U.S.A. (USNM); Western Australian Museum, Perth, Australia (WAM); Peabody Museum of Natural History, Yale University, New Haven, Connecticut, U.S.A. (YPM); Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia (ZISP); Zoologisches Museum, Museum für Naturkunde der Humboldt-Universität, Berlin, Germany (ZMB); Zoological Museum, Moscow State University, Russia (ZMMU); Zoologisk Museum, Copenhagen, Denmark (ZMUC); University Museum, Zoology, University of Tokyo, Japan (ZUMT). Collection abbreviations see also Fricke & Eschmeyer (2009).

Comparative materials: *Centrodraco abstractum* Fricke, 2002: AMS I.36455-006 (holotype), I.36455-000 (1 paratype), CAS 88652 (1), 88664 (5); *C. acanthopoma* (Regan, 1904): BMNH 1896.2.10.33 (holotype), 1998.8.9.6454 (1), MCZ 27990 (1), 39535 (1), 39990 (1), 60853 (3 + 1 C & S), 85927–85935 (9), 96833 (2), 98729 (1), 128239 (1), 149175–149178 (4), MMF 22868 (1), 22542 (3), 22880 (1), SU 51107 (1), UBC 59-308 (1), UF 109567 (3), 109575 (1), USNM 45752 (2), 46015 (1), 134187 (1), 156956–156958 (13), 158753 (4), 198024 (11), 240691–240694 (4), 307803 (2), ZMB 14011 (1), ZMUC P.64164 (1); *C. gegonipus* (Parin, 1982): IOAN uncat. (2 paratypes), uncat. (1 + 1 + 1); *C. insolitus* (McKay, 1971): BMNH 1997.9.17.36 (1), WAM P.19164-001 (holotype), P.19165-001 (1 paratype), P.19166-001 (1 paratype), P.25394-011 (1); *C. lineatus* Fricke, 1992: SMNS 12136 (1 paratype), ZISP 49940 (holotype), ZMMU 18680 (1 paratype); *C. nakaboi* Fricke, 1992: BSKU 29331 (1 paratype), ZISP 48693 (holotype), 48694 (5 paratypes); *C. oregonus* (Briggs & Berry 1959): MCZ 39991 (1 paratype), 40506 (1), 93488 (2), SU 50897 (4), 51106 (1 paratype), 68909 (1), UBC 58-307 (1 paratype), 58-307c (3), UF 5245 (3 paratypes), 203300 (3 paratypes), 204178 (6), USNM 158875 (28 paratypes), 159212 (2), 159234 (14), 159776 (holotype); *C. ornatus* (Fourmanoir & Rivaton, 1979): AMS I.19760-018 (1), HUMZ 75058 (holotype of *C. otohime* Nakabo & Yamamoto, 1980), 80237 (1 paratype of *C. otohime* Nakabo & Yamamoto, 1980), SMNS 21797 (1), YPM 10040 (1); *C. pseudoxenicus* (Kamohara, 1952): BSKU 1891–1892 (2), 4435 (1); *C. rubellus* (Fricke, Chave & Suzumoto in Fricke, 1992): BPBM 28915 (holotype), SMNS 8525 (1 paratype); *C. striatus* (Parin, 1982): IOAN uncat. (2 paratypes), uncat. (3 + 2), ZISP 45724 (holotype of *Draconetta nana* Parin, 1982); *Draconetta xenica* Jordan & Fowler, 1903: SMNS 8549 (1), 21798 (1), SAIAB 165 (holotype of *Draconetta africana* Smith, 1963), USNM 51633 (holotype of *Draconetta hawaiiensis* Gilbert, 1905), 314593 (1), 314595 (3), ZUMT 54341–54346 (6).

3 Taxonomy

Centrodraco atrifilum n. sp.
(Figs. 1–2)

Callionymus sp.: Fricke 1992: 190, fig. 14 (off Sydney, New South Wales, Australia).

Holotype: AMS I.24455-001, male, 21.2 mm SL, off Brisbane, Tasman Sea, Queensland, Australia, 27°29'S 153°50'E, 640 m depth, beam trawl, coll. RV Kimbla and party, 15 Dec. 1969, 20:25–21:30 AEST.

Paratype: AMS I.27676-007, 1 female, 33.7 mm SL, off Sydney, New South Wales, Australia, 33°41'S 151°50'E–33°50'S 151°46'E, 328–437 m depth, coll. FRV Kapala, 13 Sep. 1988.

Etymology

'Ater' (Latin) means black, 'filum' (Latin) means thread. The name refers to the black filament on the second spine of the first dorsal fin.

Diagnosis

A *Centrodraco* with 13–14 rays in the second dorsal fin, 12–13 rays in the anal fin, the first dorsal fin with the second spine elongate and filamentous in both sexes, the second dorsal fin without filaments in males, and the male body colour pattern dorsally with three pairs of vertical dark brown streaks, followed by a single saddle below the end of the second dorsal fin and on the caudal peduncle.

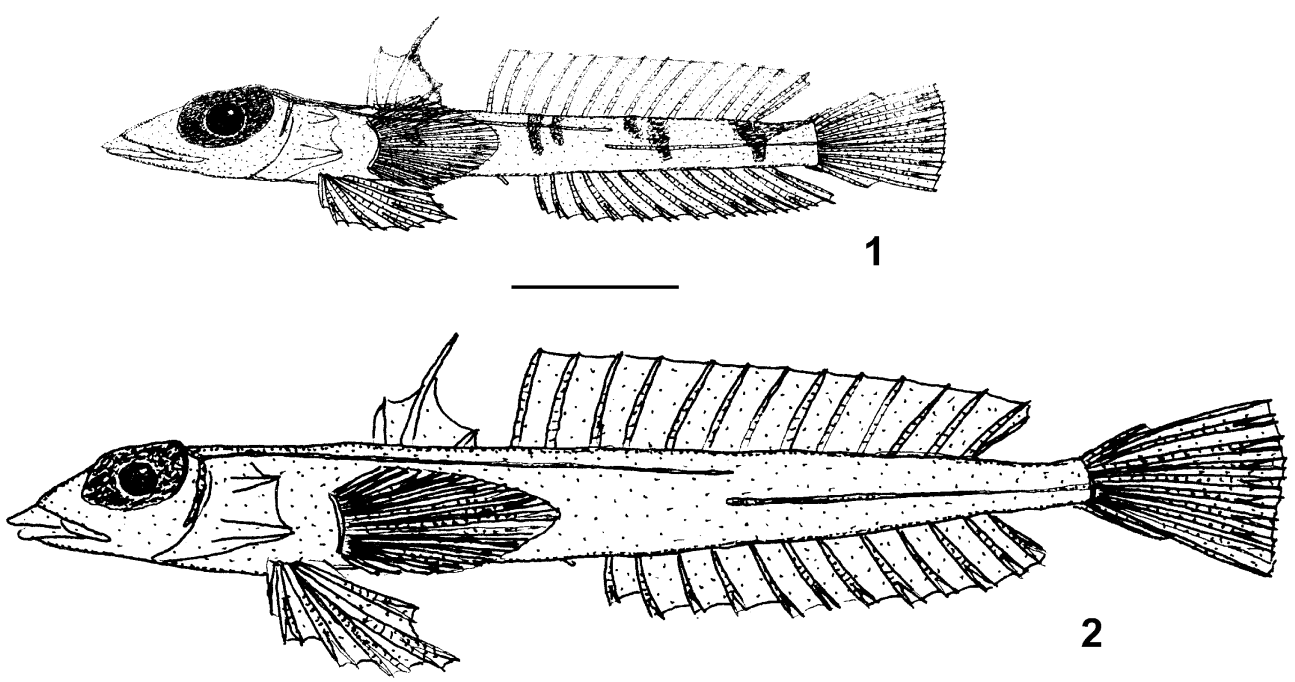
Description

D III + xiii,1 (III + xii,1); A 13 (12); P_1 iv–v,19–20, ii–iii (total 26–27) [iii,22–23,iii (total 27–28)]; P_2 I,5; C (iii),ii,8,ii,(iii) [(iii),ii,8,ii,(iii)].

Body elongate and slightly depressed. Head slightly depressed, head length 29.0 (21.6) % of SL. Eye diameter 14.1 (9.4) % of SL. Preorbital length 8 (4) % of SL. Interorbital distance 2.4 (1.3) % of SL. Upper jaw length 14.1 (8.2) % of SL. Opercle and subopercle with a strong retrorse spine each, opercular spine 1.45 (1.83) in subopercular spine. Occipital region smooth. Body depth 9.2 (10.6) % of SL. Body width 17.5 (10.9) % of SL. Urogenital papilla length 1 % of SL in male holotype. Caudal peduncle length 14.6 (8.6). Caudal peduncle depth 2.8 (4.8) % of SL.

First dorsal fin relatively low in male, but second spine bearing a filament; length of first spine 9.0 (3.7) % of SL, second spine 15.1 (11.3) % of SL, third spine 7.1 (2.0) % of SL. Predorsal (1) length 35.6 (32.1) % of SL. Second dorsal fin distally straight. Second dorsal fin rays unbranched, the last divided at base. First ray of second dorsal fin 9.4 (3.8) % of SL, last ray 11.3 (4.0) % of SL. Predorsal (2) length 52.8 (45.5) % of SL. Anal fin beginning on vertical through fourth (third) membrane of second dorsal fin. Anal fin rays branched, last unbranched but divided at base. First ray of anal fin 8.4 (4.7) % of SL, last ray 10.8 (7.0) % of SL. Preanal fin length 59.9 (54.1) % of SL. Pectoral fin reaching to anus when adpressed, pectoral fin length 17.9 (20.8) % of SL. Prepectoral fin length 36.8 (29.3) % of SL. Pelvic fin spine 15.6 (20.4) % of SL, pelvic fin length 21.2 (20.4) % of SL. Prepelvic fin length 28.8 (22.8) % of SL. Caudal fin truncate; caudal fin length 18.4 (17.2) % of SL.

Colour in alcohol: Head and body pale yellow. Eye dark grey. Sides of body in the male holotype dorsally with a row of three pairs of vertical dark brown streaks, followed by a single saddle below the end of the second dorsal fin and on the caudal peduncle. First dorsal fin in the male pale, filament on second spine and distal margin of second



Figs. 1–2. *Centrodraco atrifilum* n. sp., lateral view. – **1**. AMS I.24466-001, holotype, male, 21.2 mm SL, off Brisbane, Queensland, Australia, 640 m depth. **2**. AMS I.27676-007, paratype, female, 33.7 mm SL, off Sydney, New South Wales, Australia, 328–437 m depth. – Scale: 5 mm.

and third membranes blackish. Second dorsal, anal, caudal, pectoral and pelvic fins pale. – Female paratype pale yellowish, without markings.

Sexual dimorphism

The male differs from the female in having a higher first dorsal fin. More material is needed to judge on sexual dimorphism in colour markings.

Distribution

The male holotype was known from off Brisbane, Queensland; the paratype was collected off Sydney, New South Wales, Australia. The species is endemic to eastern Australia. It is known from depths of 437–640 m.

Habitat

The Queensland specimen was collected with a beam trawl, probably on a soft bottom. Species of *Centrodraco* usually occur on patches of soft substrate on the continental slope. As this habitat is scarce and difficult to sample, specimens are extremely rare in collections, and probably also biologically rare.

Affinities

The new species resembles *Centrodraco acanthopoma* (Regan, 1904), *C. nakaboi* Fricke, 1992 and *C. striatus* (Parin, 1982) in having the second spine of the first dorsal fin longest in male (longer than the first spine). It differs from these species in having a long filament on the second spine of the first dorsal fin (*C. acanthopoma*, *C. nakaboi* and *C. striatus*: none or a very short filament), the second dorsal fin without filaments in male (*C. striatus*: rays filamentous), the colour pattern on the sides of the body (*C. acanthopoma*: sides with 4 broad grey saddles and dark grey blotches in between; *C. nakaboi*: sides with 2–3 dark blotches; *C. striatus*: sides with 11 narrow vertical brown stripes), the pale second dorsal fin (*C. acanthopoma*: male with distal series of dark spots; *C. nakaboi*: distally dark in both sexes), the pale caudal fin (*C. nakaboi*: distally dark), and the pale anal fin (*C. striatus* and male *C. nakaboi*: distally dark).

Other species in the genus have the first spine of the first dorsal fin longest in the male, often with a filament. Several species also have the second dorsal rays filamentous, at least in males (*C. abstractum*, *C. gegonipus*, *C. insolitus*, *C. lineatus*, *C. oregonus*, *C. pseudoxenicus*), while the second dorsal rays are not filamentous in *C. atrifilum* n. sp.

Remarks

FRICKE (1992: 190) described and illustrated a single female specimen from off Sydney as *Centrodraco* sp., and remarked that this may represent an undescribed species related to *Centrodraco nakaboi* or *C. oregonus*; as the specimen completely lacked any colouration he felt the necessity to examine more material. The discovery of the male holotype from off Brisbane made it possible to describe the new species, as the collection of additional material is improbable in the near future.

The lack of colouration in the female paratype, except for the dark pigmented eye, may either be artificial due to bleaching after treatment with formalin, or natural; additional female specimens are needed to determine the natural state. The smaller eye of the female paratype may be due to allometric growth.

A revised key to draconettid fish genera and species is presented below to distinguish *Centrodraco atrifilum* n. sp. from potentially co-occurring species and other species of the family.

4 Key to genera and species of Draconettidae

1 First dorsal fin spines long and slender; second dorsal fin rays 12; anal fin rays 12; Indo-West Pacific. ..... *Draconetta* (only species: *Draconetta xenica* Jordan & Fowler, 1903)
– First dorsal fin spines stout and pungent; second dorsal fin rays 14 (rarely 12–15); anal fin rays 13 (–14). ..... *Centrodraco* **2**
2 Second dorsal fin rays with long filaments. **3**
– Second dorsal fin rays without filaments (rarely with very short filaments). **9**
3 First dorsal fin plain black; first D_1 spine shorter than second spine, not filamentous; body with dark vertical lines. – Southeastern Pacific. ..... ***C. striatus*** (Parin, 1982) (male)
– First dorsal fin light, may be distally dark; first D_1 spine longer than second spine, filamentous; body not with dark vertical lines (may bear dark horizontal lines or dark blotches). .. **4**
4 Body with 2–3 long horizontal dark streaks **5**
– Body without long horizontal dark streaks (may have dark spots or blotches or short ocellate dark streaks). **6**
5 Each anal fin membrane with a dark blotch; second dorsal fin membranes each with a vertical dark line; first D_1 spine 14.7 % or less of SL (in specimens with more than 70 mm SL); first ray of second dorsal fin less than 20 % of SL (in specimens with more than 70 mm SL). – Western Indian Ocean. ..... ***C. lineatus*** Fricke, 1992 (male)
– Anal fin light, without dark blotches; second dorsal fin membranes without vertical dark lines; first D_1 spine 14.8 % or more of SL (in specimens with more than 70 mm SL); first ray of second dorsal fin more than 23 % of SL (in specimens with more than 70 mm SL). – Central Atlantic Ocean. ..... ***C. oregonus*** (Briggs & Berry, 1959) (male)
6 Body with short ocellate lines and blotches; each A membrane with a dark spot. – West Pacific. ..... ***C. ornatus*** (Fourmanoir & Rivaton, 1979) (male)
– Body not with ocellate lines and blotches (may have small spots); anal fin plain white. **7**
7 Body densely covered with dark spots. – Japan, China. ..... ***C. pseudoxenicus*** (Kamohara, 1952) (male)
– Body plain whitish or brown; if bearing spots, not densely covered, but spots in two distinct groups. – Southeastern Pacific, Australia. **8**
8 Second dorsal fin membranes with vertical dark lines, distally dark; caudal fin base without a dark blotch. – Off northwestern Australia. ..... ***C. insolitus*** (McKay, 1971) (male)

– Second dorsal fin membranes plain whitish, without vertical lines, may be distally dark; caudal fin base with a dark brown blotch. – Southeastern Pacific..... ***C. gegonipus*** (Parin, 1982) (male)

9 First spine of first dorsal fin shorter than second spine..... **10**

– First spine of first dorsal fin longer than second spine..... **19**

10 First spine of first dorsal fin more than 1.7 in second spine; second spine with a dark filament in male. – Eastern Australia..... ***C. atrifilum* n. sp.**

– First spine of first dorsal fin less than 1.7 in second spine; second spine without a dark filament. **11**

11 First dorsal fin plain black..... **12**

– First dorsal fin not plain black (may be distally dark)..... **13**

12 Body with about 11 regular vertical dark streaks; anal fin with distal dark spots. – Southeastern Pacific..... ***C. striatus*** (Parin, 1982) (female)

– Body with irregular dark spots and blotches, not with regular vertical dark streaks; anal fin plain white. – Hawaiian Islands, Indonesia..... ***C. rubellus*** Fricke, Chave & Suzumoto in Fricke, 1992 (female)

13 Body with 2–3 long horizontal dark lines. **14**

– Body with irregular dark blotches, without horizontal dark lines. **15**

14 Each anal fin membrane with a dark blotch; second dorsal fin membranes each with a vertical dark line. – Western Indian Ocean..... ***C. lineatus*** Fricke, 1992 (female)

– Anal fin light, without dark blotches; second dorsal fin without vertical dark lines. – Central Atlantic Ocean..... ***C. oregonus*** (Briggs & Berry, 1959) (female)

15 Anal fin distally blackish; caudal fin distally blackish. – Pacific Ocean..... ***C. nakaboi*** Fricke, 1992 (male)

– Anal fin whitish, without any dark markings; caudal fin whitish, without any dark..... **16**

16 Second dorsal fin whitish, without any dark markings. – Atlantic Ocean..... ***C. acanthopoma*** (Regan, 1904) (female)

– Second dorsal fin distally dark. **17**

17 First dorsal fin whitish, without any dark markings. – Pacific Ocean..... ***C. nakaboi*** Fricke, 1992 (female)

– First dorsal fin distally dark..... **18**

18 Caudal fin plain whitish, occasionally with a basal dark blotch. – Atlantic Ocean..... ***C. acanthopoma*** (Regan, 1904) (male)

– Caudal fin with a distal dark stripe and a basal dark blotch. – Pacific Ocean..... ***C. nakaboi*** Fricke, 1992 (male)

19 First spine of first dorsal fin bearing a filament; upper third of caudal fin with a long dark streak reaching distal half of fin. – Hawaiian Islands, Indonesia..... ***C. rubellus*** Fricke, Chave & Suzumoto in Fricke, 1992 (male)

– First spine of first dorsal fin not filamentous; upper part of caudal fin without a dark streak or with a short dark streak at most in proximal one-third of fin (caudal fin may have a basal dark blotch). **20**

20 Body densely covered with numerous round dark spots. – Japan, China..... ***C. pseudoxenicus*** (Kamohara, 1952) (female)

– Body colouration not as described above; either plain brown or whitish, or with short longitudinal streaks in its dorsal part, or with groups of short transverse streaks, or with pale brown spots in two distinct groups..... **21**

21 Body with short ocellate longitudinal streaks. – West Pacific. ..... ***C. ornatus*** (Fourmanoir & Rivaton, 1979) (female)

– Body colouration not as described above; either plain brown or whitish, or with groups of short transverse streaks, or with pale brown spots in two distinct groups..... **22**

22 Caudal fin pale, without any dark markings; body usually with pale brown spots in two distinct groups. – Off northwestern Australia..... ***C. insolitus*** (McKay, 1971) (female)

– Caudal fin with a basal dark blotch; body plain brown or with groups of short longitudinal transverse streaks. – Pacific Ocean..... **23**

23 Body light, with a group of short transverse streaks under anterior half of second dorsal fin; dorsal part of caudal fin with a short dark streak; male with tips of second dorsal fin filamentous only, female without filaments. – Philippines. ..... ***C. abstractum*** Fricke, 2002

– Body plain brown; dorsal part of caudal fin pale; distal half of second dorsal fin rays filamentous. – Southeastern Pacific..... ***C. gegonipus*** (Parin, 1982) (female)

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Skull identification key for Central European waterfowl (Aves: Anseriformes: Anatidae)

Christian Ellrott & Gregor Schmitz

Abstract

Although the Anseriformes are among the most thoroughly studied bird orders in Central Europe, no precise key for the identification of their skulls was available. This paper seeks to remedy this lack by presenting a dichotomous identification key for 37 species of Anseriformes from Germany. Photographs and biometric measurements of the skulls are added to support the identification process.

Key words: Aves, Anseriformes, Anatidae, skull morphology, identification key.

Zusammenfassung

Obwohl die Entenvögel (Anseriformes) zu den gut untersuchten Vogelgruppen zählen, lag bisher kein präziser Bestimmungsschlüssel für die Schädel der mitteleuropäischen Arten vor. Mit der vorliegenden Arbeit wird diese Lücke geschlossen und ein dichotomer Schlüssel zur Bestimmung von 37 in Deutschland lebenden Entenvogelarten vorgestellt. Zur Erleichterung der Bestimmung werden Fotos und Messdaten beigefügt.

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1 Introduction

Although the Anseriformes are one of the most thoroughly studied bird orders, no identification key for the skulls of Central European species was yet available. As part of a graduate thesis project at Constance University (Ellrott 2008), the skulls of 37 German waterfowl species were measured and analyzed with regard to functional anatomy, diet and feeding behavior. Based on the underlying data and measurements, a distinction can even be made between skulls of closely related species. In this paper we present a dichotomous identification key for all 37 species of the order. In addition, we include supportive morphometric data and illustrations.

The skull of the Anseriformes is desmognathous and holorhinous. It is further characterized by the following features: Processus angularis of the lower jaw strongly developed, joint area of the articulare with a distinct caudolateral to rostromedial ridge, rostropterygoid joint situated quite rostrally (features of Galloanseres); rostral end of palatina spatulate, rostropterygoid processus pedicellate, processus retroarticularis of the lower jaw sagitally compressed and knife-shaped, occipital fontanelles present, processus paracoronoideus strongly developed (Mickoleit 2004).

Goodmann & Fisher (1962) investigated the functional anatomy of the feeding apparatus of 17 species of the Anseriformes with seven species occurring in Central Europe. In this work several measurements were presented (n = 1–28).

Brown et al. (2003) presented a skull identification key for selected species of birds, including Anseriformes. The key included general skull types and the bill-cranium-relation, and was supplemented by illustrations and some basic morphometric data. Unfortunately, the number of specimens examined was not specified (except when only one specimen was available). The illustrations were not very detailed and not comparable between species. Closely related species were shown with and without bill horn. Therefore, skulls that in reality are similar, appear to be very different. Finally, some important species are missing (e. g. *Mergellus albellus*) or represented in low numbers (e. g. *Branta bernicla* with n = 1).

Jansen & Gestel (2009) present the following measurements on their "skullsite": total length; length, width and height of cranium, upper bill length, skull relation (total length / upper bill length). The photographs are clear and informative. Unfortunately, the measurements are taken from just one specimen each. In addition, despite of the enormous number of included species, some Central European species are missing.

Because Germany has a good cross-section of the Central European fauna, we based our analysis on the species list in Barthel & Helbig (2005), but we excluded very rare species in order to keep the identification key practicable (see chapter 2, "species selection").

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2 Materials und Methods

Species selection

Species selection is based on Barthel & Helbig (2005). From the 66 Anseriformes species listed in this paper, we excluded 29 species which (1) were previously recorded as introduced, arrived by assisted transport or escaped from captivity, and whose breeding population (if any) is thought not to be self-sustaining, or (2) were classified as vagrants with an average of less than five records per year since 1980.

Tab. 1. Species included in the determination key. – Nomenclature according to Bauer et al. (2005), systematic order according to Hoyo et al. (1992).

Scientific name	English name	German name
ANSERANATINAE		
Anserini		
Cygnus olor (J. K. Gmelin, 1789)	Mute Swan	Höckerschwan
Cygnus atratus (Latham, 1790)	Black Swan	Schwarzschwan
Cygnus cygnus (Linnaeus, 1758)	Whooper Swan	Singschwan
Cygnus bewickii Yarrell, 1830	Tundra Swan	Zwergschwan
Anser fabalis (Latham, 1787)	Bean Goose	Saatgans
Anser brachyrhynchus Baillon, 1834	Pink-footed Goose	Kurzschnabelgans
Anser albifrons (Scopoli, 1769)	Greater White-fronted Goose	Blässgans
Anser erythropus (Linnaeus, 1758)	Lesser White-fronted Goose	Zwerggans
Anser anser (Linnaeus, 1758)	Greylag Goose	Graugans
Branta canadensis (Linnaeus, 1758)	Canada Goose	Kanadagans
Branta leucopsis (Bechstein, 1803)	Barnacle Goose	Weißwangengans
Branta bernicla (Linnaeus, 1758)	Brent Goose	Ringelgans
Branta ruficollis (Pallas, 1769)	Red-breasted Goose	Rothalsgans
ANATINAE		
Tadornini		
Alopochen aegyptiaca (Linnaeus, 1766)	Egyptian Goose	Nilgans
Tadorna ferruginea (Pallas, 1764)	Ruddy Shelduck	Rostgans
Tadorna tadorna (Linnaeus, 1758)	Common Shelduck	Brandgans
Cairinini		
Aix galericulata (Linnaeus, 1758)	Mandarin Duck	Mandarinente
Anatini		
Anas penelope Linnaeus, 1758	Eurasian Wigeon	Pfeifente
Anas stepera Linnaeus, 1758	Gadwall	Schnatterente
Anas crecca Linnaeus, 1758	Common Teal	Krickente
Anas platyrhynchos Linnaeus, 1758	Mallard	Stockente
Anas acuta Linnaeus, 1758	Northern Pintail	Spießente
Anas querquedula Linnaeus, 1758	Garganey	Knäkente
Anas clypeata Linnaeus, 1758	Northern Shoveler	Löffelente
Aythyini		
Netta rufina (Pallas, 1773)	Red-crested Pochard	Kolbenente
Aythya ferina (Linnaeus, 1758)	Common Pochard	Tafelente
Aythya nyroca (Güldenstädt, 1770)	Ferruginous Duck	Moorente
Aythya fuligula (Linnaeus, 1758)	Tufted Duck	Reiherente
Aythya marila (Linnaeus, 1758)	Greater Scaup	Bergente
Mergini		
Somateria mollissima (Linnaeus, 1758)	Common Eider	Eiderente
Clangula hyemalis (Linnaeus, 1758)	Long-tailed Duck	Eisente
Bucephala clangula (Linnaeus, 1758)	Common Goldeneye	Schellente
Melanitta fusca (Linnaeus, 1758)	Velvet Scoter	Samtente
Melanitta nigra (Linnaeus, 1758)	Common Scoter	Trauerente
Mergellus albellus (Linnaeus, 1758)	Smew	Zwergsäger
Mergus serrator Linnaeus, 1758	Red-breasted Merganser	Mittelsäger
Mergus merganser Linnaeus, 1758	Goosander	Gänsesäger
OXYURINAE		
Oxyurini		
Oxyura jamaicensis (J.K. Gmelin, 1789)	Ruddy Duck	Schwarzkopf-Ruderente

Materials

The skull material originates mainly from the NIKOLAUS Collection (Staatliches Museum für Naturkunde, Stuttgart). We also used specimens from the following collections: Landesdenkmalamt Baden-Württemberg, Arbeitsstelle Osteologie, Konstanz; Institut für Palaeoanatomie, Domestikationsforschung und Geschichte der Tiermedizin, Universität München; Museum für Naturkunde, Berlin; SCHMITZ Collection (Universität Konstanz).

Of the 37 species selected, we measured ten specimens each, all of which met the necessary condition, i. e. no damage that could prevent proper measuring. See Tab. 1 for the nomenclature of the included species.

For photographic documentation we chose those individuals that were the most representative (i. e. with measurements close to mean values).

Abbreviations and measurements

The skulls were measured as follows (see also Fig. 1 and Tab. 2):

Skull

TL Total length (= upper bill length plus cranial length, i. e. the total length was not measured separately)

UBL Upper bill length (measured from tip of upper bill to the middle of the fissura cranio-facialis = fronto-nasal hinge)

CL Cranial length (measured from the middle of the fissura cranio-facialis to the caudal end of the cranium)

Upper bill

TOL Tomium length

PL Premaxillary length (measured between tip of upper bill and anterior end of naris)

NL Naris length

BWUB Basal width of upper bill

UBS Upper bill shape (= bill edge shape in dorsal view, divided into three categories: divergent (=D), parallel (=P) or convergent (=C) towards bill tip)

UBH Upper bill height (= bill height in apical third)

Cranium

CH Cranial height

CW Cranial width

SOW Width of supraorbital isthmus

SG Salt gland fossa (may be absent, weakly developed or distinct)

Lower bill

LBL Lower bill length

LBH Lower bill height

In a few key couplets we added (i. e. not included in Tab. 2) basal width of premaxillary (measured at the anterior end of nares) and length (cranial – rostral) of lacrimal (Fig. 3).

Tab. 2. Measurements (in mm) of the treated 37 Anseriformes species (n = 10 per species; Max = maximum; Ø = Mean, Min = Minimum; SD = Standard deviation). – For abbreviations see chapter 2 and Fig. 1.

		Skull			Upper Bill						Cranium				Lower Bill	
		TL	UBL	CL	TOL	PL	NL	BWUB	UBS	UBH	CH	CW	SOW	SG	LBL	LBH
Cygnus olor	Max	184.2	97.5	88.4	98.4	56.8	35.5	34.7		12.6	34.3	45.7	21.7		171.0	18.9
	Ø	**178.6**	**93.3**	**85.3**	**95.0**	**52.8**	**31.7**	**33.3**	**P = 100 %**	**11.0**	**32.8**	**44.0**	**20.1**	**Absent**	**165.7**	**17.7**
	Min	172.1	89.1	82.1	91.8	49.7	27.8	31.0		10.2	31.3	41.9	17.6		159.0	16.4
	SD	4.9	3.1	2.0	2.3	2.1	2.1	1.2		0.8	0.8	1.3	1.4		4.1	0.8
Cygnus cygnus	Max	195.1	97.1	98.3	102.6	49.9	39.3	32.8		12.2	39.0	48.0	20.1		189.0	19.4
	Ø	**180.0**	**88.9**	**91.0**	**93.4**	**44.3**	**35.4**	**30.5**	**P = 100 %**	**10.6**	**36.8**	**44.9**	**17.9**	**Absent**	**169.5**	**17.2**
	Min	167.5	79.5	83.2	86.0	38.9	32.9	28.1		8.8	34.8	42.7	15.3		152.8	15.6
	SD	8.8	5.0	4.2	5.3	3.0	1.8	1.5		1.0	1.3	1.6	1.3		10.7	1.1
Cygnus bewickii	Max	169.2	81.4	87.9	86.5	38.9	34.6	30.5		12.6	36.3	44.7	17.9		160.0	17.1
	Ø	**156.5**	**74.4**	**82.1**	**80.1**	**36.5**	**30.4**	**29.0**	**P = 100 %**	**10.0**	**34.3**	**41.6**	**15.5**	**Absent**	**146.1**	**15.7**
	Min	144.7	69.3	75.4	74.4	33.6	26.9	27.7		8.0	32.5	38.3	13.8		132.7	14.0
	SD	7.5	4.3	3.5	4.3	2.0	2.2	1.0		1.3	1.2	1.9	1.3		8.6	0.9
Anser fabalis	Max	125.0	68.2	59.0	60.6	33.0	23.6	26.4		7.5	34.4	35.7	15.4		111.2	17.3
	Ø	**116.9**	**61.4**	**55.5**	**55.2**	**29.5**	**21.8**	**24.4**	**C = 100 %**	**6.7**	**32.4**	**33.2**	**13.5**	**Absent**	**102.3**	**15.8**
	Min	110.8	56.8	53.3	50.1	27.1	19.4	22.8		6.1	30.9	26.5	11.1		93.9	15.1
	SD	5.8	4.0	2.1	3.6	2.0	1.2	1.1		0.5	1.1	2.5	1.3		5.5	0.7
Anser brachyrhynchus	Max	108.6	53.3	55.5	46.5	23.9	20.1	24.4		7.6	32.0	34.9	15.5		91.8	13.6
	Ø	**100.7**	**48.2**	**52.5**	**43.1**	**21.4**	**17.8**	**22.0**	**C = 100 %**	**6.4**	**30.0**	**31.8**	**13.2**	**Absent**	**85.9**	**12.4**
	Min	92.8	43.2	49.7	39.2	19.0	15.5	18.5		5.2	28.1	28.9	10.0		78.4	11.8
	SD	5.0	3.0	2.3	2.2	1.5	1.5	1.7		0.7	1.4	1.8	1.5		4.5	0.6

		Skull			Upper Bill						Cranium				Lower Bill	
		TL	UBL	CL	TOL	PL	NL	BWUB	UBS	UBH	CH	CW	SOW	SG	LBL	LBH
Anser albifrons	Max	110.0	55.3	55.8	50.3	25.8	19.5	24.1		6.8	30.7	32.3	13.8		94.7	13.3
	Ø	**104.7**	**51.8**	**52.9**	**46.8**	**24.1**	**18.9**	**23.0**	**C = 100 %**	**6.2**	**29.5**	**31.1**	**12.4**	**Absent**	**89.2**	**12.6**
	Min	98.7	48.3	50.4	43.8	22.8	17.6	21.7		5.1	27.3	29.6	10.8		82.8	11.2
	SD	3.4	2.1	1.6	2.1	1.1	0.6	0.7		0.5	0.8	0.9	0.9		3.5	0.5
Anser erythropus	Max	94.1	44.3	49.8	37.7	19.2	16.9	21.2		6.4	26.8	30.1	12.5		76.4	10.9
	Ø	**88.5**	**40.5**	**48.0**	**35.0**	**16.7**	**15.8**	**19.5**	**C = 100 %**	**5.5**	**25.9**	**28.7**	**11.3**	**Absent**	**72.8**	**10.0**
	Min	85.1	38.1	45.5	32.6	15.1	14.7	17.3		4.9	24.9	27.1	9.8		68.1	9.2
	SD	3.0	2.0	1.6	1.7	1.1	0.8	1.2		0.4	0.6	0.9	0.7		2.6	0.6
Anser anser	Max	133.9	72.1	61.8	62.9	33.4	26.9	31.6		8.6	35.0	37.6	18.0		113.7	17.6
	Ø	**124.7**	**65.2**	**59.5**	**58.3**	**30.6**	**23.6**	**28.6**	**C = 100 %**	**8.2**	**33.4**	**36.1**	**15.0**	**Absent**	**107.6**	**16.5**
	Min	117.6	60.0	57.0	55.3	28.7	21.6	25.7		7.8	31.6	34.2	13.8		102.3	15.6
	SD	4.4	3.4	1.5	2.2	1.4	1.6	1.6		0.3	1.1	1.0	1.2		2.7	0.5
Branta canadensis	Max	136.9	68.5	68.4	62.0	33.8	29.1	27.8		7.7	35.5	38.8	15.9		119.3	15.3
	Ø	**128.5**	**63.9**	**64.6**	**59.3**	**29.0**	**25.6**	**25.2**	**C = 70 %**	**7.0**	**33.4**	**36.4**	**13.5**	**Distinct or weak**	**113.6**	**14.2**
	Min	118.8	58.8	59.9	53.1	25.4	23.7	20.5	P = 30 %	6.1	31.9	33.8	11.8		104.3	12.8
	SD	4.7	2.8	2.9	2.6	2.3	1.8	1.9		0.5	1.1	1.3	1.2		4.2	0.6
Branta leucopsis	Max	91.5	40.1	51.9	34.2	16.9	16.5	19.0		6.0	28.3	31.2	12.8		76.1	10.4
	Ø	**86.9**	**37.1**	**49.8**	**31.7**	**15.6**	**15.2**	**17.5**	**C = 100 %**	**5.5**	**26.6**	**28.9**	**10.8**	**Weak or absent**	**71.2**	**9.8**
	Min	83.2	34.5	48.1	29.7	14.3	13.8	16.5		4.8	25.5	27.5	9.0		68.3	8.8
	SD	2.8	1.7	1.3	1.4	0.7	1.0	0.7		0.4	0.9	1.1	0.9		2.7	0.5
Branta bernicla	Max	98.8	46.8	53.6	41.6	18.1	21.0	19.6		6.4	25.7	29.4	9.8		85.6	10.4
	Ø	**92.1**	**41.6**	**50.5**	**37.1**	**16.5**	**18.5**	**18.4**	**C = 100 %**	**5.6**	**24.9**	**28.4**	**8.7**	**Distinct**	**77.8**	**9.2**
	Min	87.4	39.3	48.1	34.6	15.8	17.5	17.2		5.2	23.9	27.3	7.4		72.2	8.4
	SD	3.3	2.1	1.8	1.8	0.8	1.0	0.8		0.3	0.6	0.8	0.8		4.1	0.6
Branta ruficollis	Max	79.9	33.8	46.4	28.3	13.6	14.5	18.3		5.8	25.4	26.6	11.3		68.0	9.4
	Ø	**76.8**	**32.0**	**44.8**	**26.3**	**12.8**	**13.5**	**16.8**	**C = 100 %**	**5.4**	**24.0**	**25.1**	**9.8**	**Weak**	**62.2**	**8.5**
	Min	72.2	29.4	42.7	23.2	11.0	12.6	15.4		4.7	23.2	24.1	8.7		58.7	8.3
	SD	2.7	1.4	1.4	1.4	0.7	0.7	0.9		0.3	0.7	0.9	0.8		2.6	0.3
Alopochen aegyptiaca	Max	115.8	53.4	62.5	53.0	30.4	18.9	22.4		8.2	29.1	32.4	14.8		100.9	11.9
	Ø	**111.6**	**51.3**	**60.3**	**49.7**	**28.7**	**17.5**	**21.2**	**P = 90 %**	**7.4**	**28.1**	**31.5**	**12.8**	**Absent**	**96.3**	**10.9**
	Min	107.8	48.6	58.1	47.5	26.8	14.9	19.7	C = 10 %	6.8	27.3	29.7	11.1		92.6	10.1
	SD	2.5	1.4	1.6	1.6	0.9	1.2	0.7		0.4	0.6	0.8	1.1		2.9	0.6
Tadorna ferruginea	Max	106.9	47.9	59.7	53.5	30.4	14.1	19.9		8.4	24.7	28.6	12.4		98.9	10.2
	Ø	**101.9**	**45.1**	**56.8**	**49.9**	**28.0**	**13.4**	**18.4**	**P = 100 %**	**7.2**	**23.9**	**27.5**	**10.9**	**Absent**	**92.3**	**9.7**
	Min	94.1	41.7	52.4	44.9	24.8	12.6	17.2		6.3	23.2	25.6	9.6		84.4	9.1
	SD	3.7	1.7	2.1	2.4	1.6	0.5	0.8		0.6	0.5	0.8	1.0		4.1	0.3
Tadorna tadorna	Max	105.4	49.2	56.2	58.2	33.0	14.3	18.3		6.3	23.6	28.4	7.7		102.8	12.1
	Ø	**97.7**	**44.5**	**53.2**	**53.4**	**29.7**	**12.8**	**17.1**	**D = 100 %**	**5.2**	**22.7**	**26.9**	**7.1**	**Weak**	**93.9**	**10.3**
	Min	89.1	39.8	49.3	48.1	26.4	11.2	15.7		3.8	21.8	25.3	6.1		84.9	9.3
	SD	4.9	2.6	2.4	3.1	1.8	0.9	0.8		0.7	0.7	0.9	0.5		5.3	0.8
Aix galericulata	Max	81.7	34.6	47.1	35.3	20.3	10.6	14.9		4.6	23.1	24.0	9.4		67.1	7.1
	Ø	**78.2**	**33.0**	**45.2**	**33.3**	**19.1**	**9.8**	**14.2**	**C = 80 %**	**4.3**	**22.7**	**23.2**	**8.8**	**Absent**	**64.2**	**6.7**
	Min	74.5	30.3	43.0	30.7	17.0	9.3	13.8	P = 20 %	3.7	22.0	22.2	7.4		61.3	6.3
	SD	2.1	1.1	1.3	1.3	0.8	0.4	0.3		0.3	0.3	0.7	0.6		1.8	0.3
Anas penelope	Max	89.1	39.4	49.7	41.2	26.6	10.1	16.1		5.4	22.7	23.9	6.6		78.6	8.7
	Ø	**84.4**	**36.4**	**48.0**	**38.3**	**24.4**	**9.3**	**15.2**	**P = 100 %**	**4.9**	**21.8**	**23.4**	**6.0**	**Weak**	**74.2**	**8.3**
	Min	81.0	34.3	46.5	35.6	22.0	8.3	13.9		4.6	21.1	22.6	5.5		70.6	7.9
	SD	2.3	1.3	1.2	1.5	1.2	0.5	0.7		0.3	0.4	0.5	0.4		2.3	0.3

		Skull			Upper Bill						Cranium				Lower Bill	
		TL	UBL	CL	TOL	PL	NL	BWUB	UBS	UBH	CH	CW	SOW	SG	LBL	LBH
Anas stepera	Max	100.5	47.8	52.6	51.5	34.4	12.0	16.3		6.0	22.0	23.7	8.1		93.2	9.4
	Ø	**96.3**	**45.3**	**51.0**	**48.1**	**31.7**	**11.4**	**15.6**	**P=100 %**	**5.4**	**21.3**	**23.1**	**7.3**	**Absent**	**87.4**	**8.6**
	Min	92.3	42.7	48.4	45.2	30.6	10.2	14.6		4.9	20.8	22.3	6.8		81.8	8.0
	SD	2.4	1.5	1.1	1.7	1.1	0.6	0.6		0.4	0.4	0.5	0.4		3.1	0.4
Anas crecca	Max	81.9	39.0	43.9	42.9	28.5	9.8	13.0		5.6	20.9	21.2	7.2		74.5	7.4
	Ø	**79.0**	**36.5**	**42.5**	**39.9**	**26.3**	**8.5**	**12.5**	**P=100 %**	**4.9**	**20.2**	**19.6**	**6.4**	**Absent**	**70.4**	**6.7**
	Min	76.2	34.2	41.3	37.9	24.4	7.5	11.2		4.5	19.0	18.3	5.1		68.1	6.3
	SD	1.9	1.5	0.8	1.5	1.2	0.7	0.5		0.3	0.5	0.8	0.6		2.1	0.3
Anas platyrhynchos	Max	117.4	57.6	59.8	62.6	38.2	15.7	21.3		8.6	27.2	28.9	10.6		107.3	10.6
	Ø	**109.5**	**53.1**	**56.5**	**58.4**	**36.1**	**13.7**	**19.3**	**P=60 %**	**7.8**	**26.3**	**26.6**	**9.8**	**Absent**	**99.7**	**9.9**
	Min	103.5	48.3	54.3	53.1	32.8	11.9	18.3	D=40 %	7.1	25.4	25.2	8.3		92.4	8.6
	SD	4.4	2.9	1.7	3.2	2.0	1.0	0.9		0.4	0.5	1.1	0.6		4.6	0.6
Anas acuta	Max	111.3	54.5	56.7	61.2	39.0	13.5	17.4		8.2	25.0	26.9	10.0		103.1	10.3
	Ø	**104.5**	**50.6**	**53.9**	**55.9**	**35.9**	**12.4**	**16.5**	**P=50 %**	**6.7**	**23.8**	**25.8**	**9.0**	**Absent**	**96.0**	**9.6**
	Min	95.9	45.8	50.2	51.1	32.6	10.8	15.7	D=50 %	5.2	23.0	23.7	8.2		86.9	8.8
	SD	4.4	2.5	2.0	3.0	1.8	0.9	0.5		1.0	0.5	1.0	0.6		4.5	0.4
Anas querquedula	Max	83.5	40.5	43.5	44.2	29.3	10.0	14.6		6.7	20.3	21.0	6.9		74.9	7.4
	Ø	**80.3**	**37.8**	**42.4**	**41.8**	**27.0**	**9.5**	**13.8**	**P=90 %**	**5.6**	**19.8**	**19.9**	**6.2**	**Absent**	**71.9**	**6.7**
	Min	76.6	36.1	40.3	39.5	24.7	8.7	13.1	D=10 %	4.9	19.4	18.3	5.6		69.3	6.2
	SD	1.9	1.2	0.9	1.4	1.2	0.4	0.5		0.6	0.3	0.9	0.4		1.6	0.3
Anas clypeata	Max	121.5	66.6	54.9	71.8	49.2	15.2	16.1		10.0	22.9	22.8	7.5		112.6	8.7
	Ø	**112.8**	**60.8**	**52.0**	**66.0**	**43.8**	**13.9**	**15.2**	**D=100 %**	**8.2**	**21.8**	**21.9**	**6.8**	**Absent**	**104.8**	**8.1**
	Min	106.2	56.9	49.3	59.2	40.3	12.2	14.3		6.8	21.0	21.1	5.3		99.3	7.4
	SD	5.2	3.4	2.0	4.2	2.9	0.8	0.6		0.9	0.5	0.6	0.7		4.8	0.4
Netta rufina	Max	104.1	53.3	51.9	53.8	32.5	15.7	24.4		5.5	23.7	27.3	8.9		93.7	9.8
	Ø	**100.1**	**50.4**	**49.8**	**51.4**	**30.6**	**14.1**	**22.6**	**C=80 %**	**4.1**	**22.7**	**26.3**	**8.0**	**Absent (or weak)**	**89.3**	**9.2**
	Min	94.4	46.9	47.5	48.2	27.9	12.8	21.4	P=20 %	3.3	21.8	25.4	6.9		84.4	8.7
	SD	2.9	1.9	1.3	1.7	1.4	0.8	0.9		0.7	0.5	0.6	0.5		2.5	0.3
Aythya ferina	Max	104.4	51.5	53.4	54.9	32.6	14.2	19.4		7.7	25.5	27.5	9.1		96.1	11.1
	Ø	**99.2**	**47.3**	**51.9**	**51.0**	**30.1**	**13.1**	**18.7**	**P=100 %**	**6.7**	**24.7**	**26.9**	**7.9**	**Absent (or weak)**	**90.6**	**10.5**
	Min	95.5	44.6	50.3	47.2	28.1	12.2	16.9		5.2	24.1	26.2	6.9		86.9	9.7
	SD	2.5	1.8	1.0	1.9	1.2	0.6	0.7		0.7	0.4	0.4	0.7		2.6	0.5
Aythya nyroca	Max	89.0	43.0	46.0	46.0	27.5	11.9	18.2		7.1	23.1	24.7	8.6		79.3	8.6
	Ø	**85.4**	**40.9**	**44.5**	**43.9**	**25.9**	**10.8**	**16.5**	**P=80 %**	**5.8**	**22.2**	**23.7**	**8.2**	**Absent**	**76.2**	**7.9**
	Min	80.7	38.3	42.4	40.9	24.2	9.8	13.8	D=20 %	5.1	21.5	22.8	7.8		71.0	7.2
	SD	2.3	1.2	1.1	1.4	0.9	0.6	1.3		0.6	0.5	0.5	0.2		2.2	0.4
Aythya fuligula	Max	97.0	45.9	51.1	50.8	27.8	13.7	22.0		7.6	24.1	26.1	8.3		88.6	10.9
	Ø	**87.7**	**40.3**	**47.4**	**44.9**	**25.6**	**11.6**	**19.3**	**D=70 %**	**6.8**	**22.3**	**24.7**	**7.6**	**Absent or weak**	**78.4**	**9.0**
	Min	83.9	37.4	44.8	41.9	23.9	10.7	17.9	P=30 %	6.2	21.2	23.9	7.2		74.6	8.3
	SD	3.4	2.1	1.5	2.2	1.1	0.8	1.1		0.5	0.8	0.7	0.3		3.7	0.7
Aythya marila	Max	99.1	46.1	53.0	51.5	28.5	13.8	21.5		8.9	24.5	28.8	7.5		91.6	11.7
	Ø	**95.5**	**44.0**	**51.5**	**49.3**	**26.9**	**13.0**	**20.0**	**D=100 %**	**7.7**	**23.4**	**26.8**	**7.0**	**Distinct or weak**	**87.0**	**10.3**
	Min	89.6	41.4	48.2	45.6	25.2	12.3	18.3		5.9	22.1	25.1	6.3		80.9	9.0
	SD	2.7	1.4	1.4	1.7	1.0	0.5	1.2		1.0	0.7	1.0	0.4		3.1	0.7
Somateria mollissima	Max	130.6	58.7	73.2	61.9	26.9	25.7	26.0		10.1	28.8	34.9	8.5		120.5	17.2
	Ø	**125.7**	**56.0**	**69.7**	**59.1**	**25.7**	**23.0**	**24.0**	**C=50 %**	**8.7**	**27.7**	**32.6**	**7.8**	**Distinct**	**114.2**	**15.5**
	Min	120.5	53.5	66.8	56.5	24.4	21.5	22.6	P=50 %	7.3	26.8	30.5	6.4		107.9	14.6
	SD	3.0	1.8	2.0	1.6	0.9	1.1	1.2		0.9	0.5	1.3	0.7		3.3	0.7

		Skull			Upper Bill						Cranium				Lower Bill	
		TL	UBL	CL	TOL	PL	NL	BWUB	UBS	UBH	CH	CW	SOW	SG	LBL	LBH
	Max	83.1	32.0	51.4	39.4	16.0	14.1	17.4		8.3	21.4	27.0	6.0		75.5	8.0
Clangula hyemalis	**Ø**	**79.5**	**30.6**	**48.9**	**37.2**	**15.2**	**13.0**	**16.5**	**P = 100 %**	**7.4**	**20.6**	**25.7**	**5.2**	**Distinct**	**72.2**	**7.4**
	Min	75.2	28.4	46.4	34.8	14.3	12.0	15.4		6.6	19.8	24.4	4.7		68.4	6.9
	SD	2.7	1.1	1.8	1.5	0.6	0.5	0.6		0.6	0.5	0.7	0.4		2.4	0.3
	Max	92.9	38.2	55.9	44.2	15.7	15.7	20.9		9.8	27.7	28.9	17.1		81.5	10.1
Bucephala clangula	**Ø**	**86.1**	**34.4**	**51.7**	**40.7**	**14.4**	**13.7**	**18.9**	**P = 80 %**	**8.6**	**25.5**	**27.0**	**13.1**	**Absent**	**75.6**	**8.8**
	Min	80.5	31.4	48.2	37.6	13.2	12.2	16.7	C = 20 %	7.1	23.2	25.6	11.2		69.8	7.9
	SD	4.8	2.3	2.7	2.7	0.7	1.0	1.4		0.8	1.5	1.2	2.0		4.8	0.8
	Max	114.7	55.8	59.5	62.7	28.8	17.1	27.0		8.3	27.4	30.3	10.3		106.8	12.8
Melanitta fusca	**Ø**	**108.5**	**51.8**	**56.6**	**58.4**	**26.6**	**16.3**	**24.2**	**P = 80 %**	**7.4**	**26.1**	**29.0**	**8.9**	**Distinct**	**99.7**	**11.4**
	Min	100.3	47.3	53.1	53.8	23.9	15.5	21.8	D = 20 %	6.6	24.8	27.2	7.7		92.8	10.2
	SD	5.5	3.5	2.2	3.5	1.8	0.5	1.9		0.7	1.0	1.1	0.7		5.4	0.9
	Max	103.7	50.8	52.9	56.2	24.9	14.8	22.6		7.9	26.4	28.3	8.5		96.8	11.1
Melanitta nigra	**Ø**	**97.3**	**45.8**	**51.4**	**51.3**	**22.5**	**13.5**	**20.5**	**P = 90 %**	**5.6**	**24.9**	**26.8**	**7.1**	**Distinct**	**89.8**	**10.6**
	Min	91.8	41.5	48.9	47.3	20.7	12.5	17.0	C = 10 %	4.1	23.8	25.3	6.0		82.6	9.8
	SD	4.0	2.9	1.2	3.0	1.4	0.8	1.7		1.2	0.7	0.9	0.7		4.5	0.4
	Max	78.9	38.3	41.6	35.0	17.5	11.9	12.1		2.6	20.6	25.2	7.6		70.3	8.3
Mergellus albellus	**Ø**	**75.2**	**35.9**	**39.3**	**32.5**	**16.6**	**10.6**	**11.6**	**C = 100 %**	**2.3**	**19.9**	**23.7**	**6.5**	**Absent**	**66.1**	**7.6**
	Min	70.0	32.4	37.5	29.4	15.0	9.3	9.8		2.0	19.4	22.7	5.8		59.2	5.8
	SD	2.9	1.8	1.2	1.7	0.8	0.9	0.7		0.2	0.4	0.7	0.6		3.5	0.7
	Max	118.5	72.3	47.4	66.8	45.0	17.1	14.5		2.5	20.4	30.0	7.5		114.4	8.6
Mergus serrator	**Ø**	**108.4**	**64.0**	**44.4**	**60.2**	**39.1**	**14.7**	**13.0**	**C = 100 %**	**2.3**	**19.9**	**27.3**	**6.6**	**Absent**	**103.5**	**7.7**
	Min	97.7	56.0	41.7	51.4	34.1	13.2	11.5		2.1	19.2	25.5	6.0		90.4	6.9
	SD	6.7	5.2	1.7	4.9	3.4	1.1	0.9		0.2	0.4	1.2	0.5		7.3	0.5
	Max	124.0	70.6	54.1	64.4	36.8	18.3	17.5		2.8	22.3	32.2	12.5		117.4	10.6
Mergus merganser	**Ø**	**115.6**	**64.4**	**51.1**	**59.5**	**33.6**	**16.4**	**15.3**	**C = 100 %**	**2.3**	**21.1**	**30.7**	**11.4**	**Mostly weak**	**109.0**	**9.1**
	Min	103.4	55.6	47.0	51.6	28.7	14.1	13.0		1.9	19.8	29.1	9.4		96.3	7.5
	SD	8.2	5.6	2.7	5.2	3.0	1.4	1.6		0.3	0.8	1.1	0.9		8.0	1.1
	Max	85.7	40.7	45.7	43.9	22.4	15.8	18.5		7.5	22.5	23.5	8.5		77.1	9.7
Oxyura jamaicensis	**Ø**	**82.7**	**38.1**	**44.6**	**41.7**	**21.2**	**14.4**	**17.5**	**D = 100 %**	**6.1**	**21.1**	**22.8**	**6.2**	**Absent**	**74.6**	**8.7**
	Min	79.8	36.2	43.6	39.8	20.0	13.0	16.5		4.9	20.2	22.3	5.5		72.5	8.1
	SD	1.6	1.3	0.7	1.1	0.8	0.7	0.6		0.7	0.6	0.5	0.8		1.4	0.4

3 Identification key

The complete data set of all 37 species (each based on 10 specimens) is presented in Tab. 2.

1 Upper bill narrow, < 9 mm wide (measured in the middle of the bill between tip and naris). ..... (M e r g i n i) **2**
– Upper bill broadened, duck- or goose-like, > 9 mm wide. **4**
2 Premaxillary anterior to naris relatively short: PL < 1.5 times NL (Fig. 5a); UBL < 40 mm. – Fig. 44. ..... ***Mergellus albellus***
– Premaxillary anterior to naris relatively long: PL > 2 times NL (Fig. 5b, c); UBL > 40 mm. **3**
3 SOW < 7.5 mm; PL (Ø 39.1 mm) about 2.5 times NL (Ø 14.7 mm); bill tip slightly down curved (Fig. 5c). – Fig. 45. ..... ***Mergus serrator***
– SOW > 9 mm; PL (Ø 33.6 mm) about 2 times NL (Ø 16.4 mm); bill tip often distinctly down curved (Fig. 5b). – Fig. 46. ..... ***Mergus merganser***
4 UBL > 140 mm and length of lacrimal (cf. Fig. 3) > 25 mm. [In large geese (*Anser*), the cross-section of the premaxillary is thickened and spongious, whereas in *Cygnus* it is flattened; *Cygnus atratus* (only a single skull studied): UBL ca. 142 mm, length of lacrimal ca. 23 mm, SG distinct]. .... (A n s e r i n i : *Cygnus*) **5**
– UBL < 140 mm and length of lacrimal < 23 mm. **7**
5 Braincase flattened in lateral view, dorsal roof of the braincase with a slight transverse depression dorsally (Fig. 3a); protrusion above the bill usually present (particularly in males); processus orbitalis of lacrimal without rostral extension. – Fig. 8. ..... ***Cygnus olor***
– Braincase rounded in lateral view and without a transverse depression dorsally (Fig. 3b); protrusion above the bill absent or slightly developed; processus orbitalis of lacrimal with rostral extension. **6**
6 Bill long: TOL mostly > 85 mm (86–102 mm), PL 38.9–50.0 mm; processus orbitalis of lacrimal with a wide constriction (width of constriction 6.5–10.0 mm) (Fig. 3b). – Fig. 9. ..... ***Cygnus cygnus***
– Bill shorter: TOL mostly < 85 mm (75–86 mm), PL 33.6–38.9 mm; processus orbitalis of lacrimal with a narrow

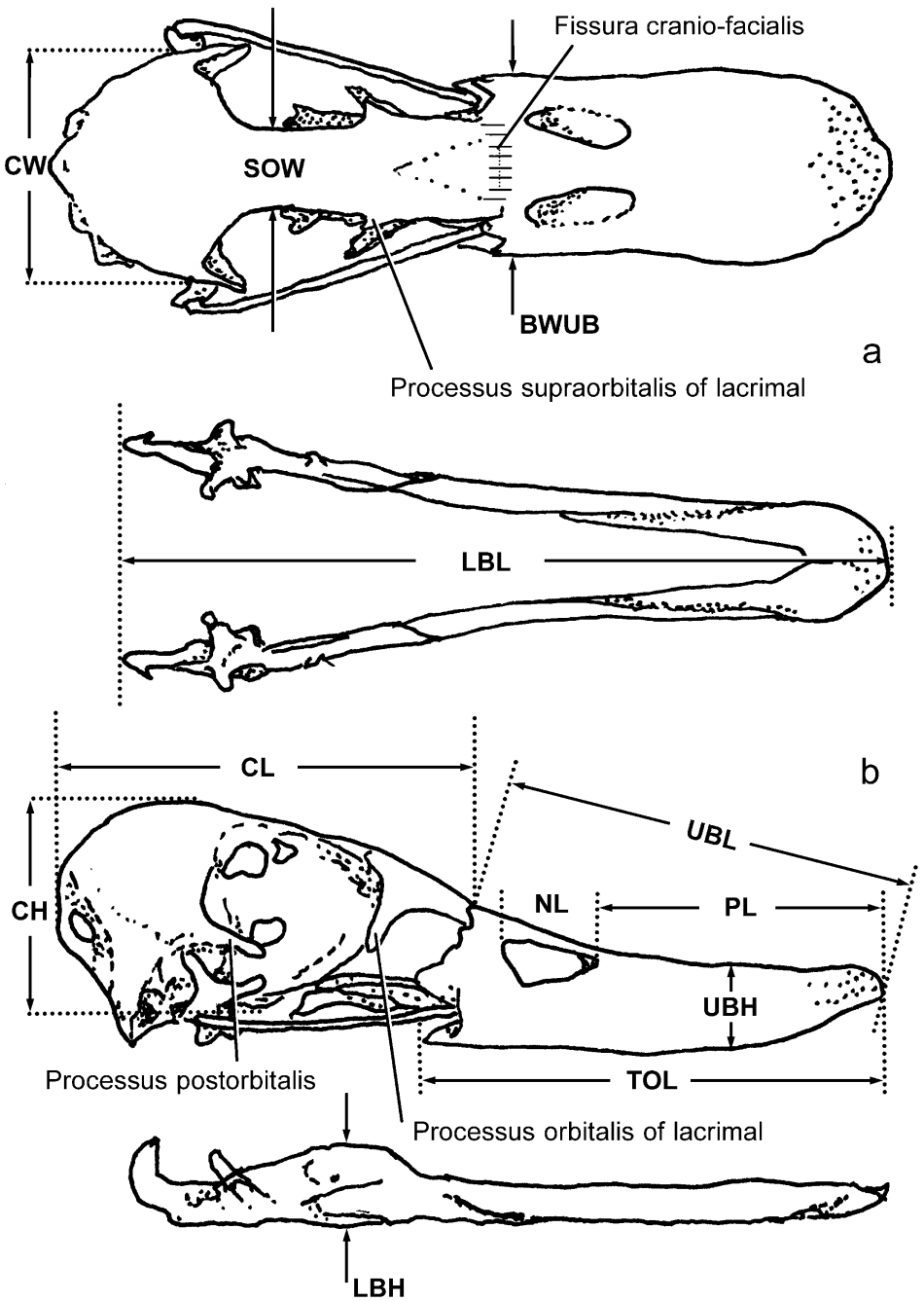


Fig. 1. Measurements of a duck skull (*Aythya fuligula*) in (a) dorsal and (b) lateral view. – For abbreviations see chapter 2.

constriction (width of constriction 4.5–7.0 mm). – Fig. 10. ... . ***Cygnus bewickii***

7 Skull with at least two of the following three features: Edges of upper bill convergent in dorsal view; lower edge of upper bill in lateral view concave over nearly its entire length; premaxillary anterior to naris entirely filled with inner spongy bone structure and bill tip curved rostrally. .... (Anserini) **8**

– Skull with at least two of the following three features: Edges of upper bill parallel or divergent in dorsal view; lower edge of upper bill straight or convex in lateral view; premaxillary anterior to naris single-layered at least in some lateral parts. **16**

8 Processus supraorbitalis of lacrimal (cf. Fig. 1) slightly developed or blunt; SG always absent (Fig. 4a) (*Anser*). [Processus supraorbitalis may be distinct in domestic breeds of *Anser anser*, wild relatives have a maximum TL of 135 mm.]..... **9**

– Processus supraorbitalis of lacrimal distinct and curved backwards; SG distinct or slightly developed (Fig. 4b). ..... (*Branta*) **13**

9 Frontal region posterior to the fissura cranio-facialis medially slightly bulged in the midline (Fig. 7a, b). **10**

– Frontal region posterior to the fissura cranio-facialis straight or concave (Fig. 7c–e)..... **11**

10 TOL 32–38 mm (see also Fig. 7a). – Fig. 14..... ***Anser erythropus***

– TOL 43–51 mm (see also Fig. 7b). – Fig. 13.... ***Anser albifrons***

11 PL 19–24 mm; culmen above the naris convex (Fig. 7e). – Fig. 12. ..... ***Anser brachyrhynchus***

– PL > 26 mm..... **12**

12 Basal width of premaxillary 15–18 mm (measured at the anterior end of nares); NL 19–24 mm (Fig. 7d). – Fig. 11. ..... ***Anser fabalis***

– Basal width of premaxillary 18–21 mm; NL 21–27 mm (Fig. 7c). – Fig. 15..... ***Anser anser***

13 TOL > 50 mm. – Fig. 16..... ***Branta canadensis***

– TOL > 45 mm..... **14**

14 TL < 80 mm. – Fig. 19..... ***Branta ruficollis***

– TL > 80 mm. **15**

15 SG distinct; CH 23–26 mm. – Fig. 18. ..... ***Branta bernicla***

– SG weakly developed or absent; CH 25–29 mm. – Fig. 17.... ***Branta leucopsis***

16 Processus supraorbitalis of lacrimal prominent, spine-shaped (Figs. 36, 43); edges of upper bill divergent and NL > 12 mm; SG mostly distinct. ..... (M e r g i n i without *Mergus*, *Mergellus*, and *Bucephala*) **17**

– Processus supraorbitalis of lacrimal not prominent (if prominent, as occasionally in *Aythya marila* and *A. fuligula*, then edges of upper bill divergent and NL < 15 mm); SG mostly absent..... **19**

17 TL < 85 mm. – Fig. 37..... ***Clangula hyemalis***

– TL > 120 mm. – Fig. 36..... ***Somateria mollissima***

– TL 90–115 mm. ..... (*Melanitta*) **18**

18 Minimum distance between nostrils > 2.5 mm; males with lateral protuberances near bill base. – Figs. 40, 41. ..... ***Melanitta fusca***

– Minimum distance between nostrils < 2.5 mm; males with a pair of distinct protuberances between the nares and the fissura cranio-facialis. – Figs. 42, 43..... ***Melanitta nigra***

19 Processus orbitalis of lacrimal elongated, sword-shaped, reaches or extends beyond the vertical axis through the centre of the orbit; premaxillary anterior to naris nearly as long as naris. – Figs. 38, 39..... ***Bucephala clangula***

– Processus orbitalis of lacrimal thin or with broadened tip, never reaches the vertical axis through the centre of the orbit; premaxillary anterior to naris at least 1.5 times NL. .. **20**

20 Upper bill flattened, its edges divergent and bill tip conspicuously upturned; PL ca. 1.5 times NL; processus orbitalis of lacrimal short, blunt; posterior edge of orbit conspicuously rounded. – Fig. 47. ..... ***Oxyura jamaicensis***

– Upper bill shaped differently; PL at least 2 times NL; processus orbitalis of lacrimal elongated; posterior edge of orbit (except in *Tadorna tadorna*) not conspicuously rounded..... **21**

21 Bill narrow, i. e. < 13 mm wide in rostral third of the bill a n d bill edges convergent; SOW < 7.3 mm. – Fig. 23. ..... ***Aix galericulata***

– Bill relatively wide, i. e. width in rostral third of the bill > 13 mm (if < 13 mm, then upper bill edges not convergent); SOW > 7.3 mm..... **22**

22 Upper and lower bill entirely upturned; posterior edge of orbit conspicuously rounded. – Fig. 22..... ***Tadorna tadorna***

– Upper and lower bill not conspicuously upturned; posterior edge of orbit not conspicuously rounded. **23**

23 Braincase stout, CW > 29 mm; bill goose-like, i. e. edges slightly convergent and curved at bill tip; front very wide in lacrimal area (Fig. 2). – Fig. 20..... ***Alopochen aegyptiaca***

– Braincase less stout, CW < 29 mm; bill duck-like, i. e. ± flattened at bill tip (sometimes slightly curved in nail region); front less wide in lacrimal area..... **24**

24 Processus orbitalis of lacrimal narrow, its edges parallel or pointed apically. ..... (A y t h i n i) **25**

– Processus orbitalis of lacrimal apically plane and broadened..... (A n a t i n i + *Tadorna ferruginea*) **29**

25 Upper bill very flat, edges convergent, bill tip acuminate, BWUB > 21 mm. – Fig. 31..... ***Netta rufina***

– Upper bill edges parallel or divergent, BWUB < 21 mm..... (*Aythya*) **26**

26 Upper bill edges parallel a n d TOL > 47 mm. – Fig. 32. ..... ***Aythya ferina***

– Upper bill edges divergent (if parallel then TOL < 47 mm)... **27**

27 Maximum upper bill width < 20 mm; ridge between nares and bill tip rather flattened, < 7.1 mm high. – Fig. 33. ..... ***Aythya nyroca***

– Maximum upper bill width > 20 mm; ridge between nares and bill tip less flattened, usually > 7.1 mm high..... **28**

28 TL < 89 mm; width of fissura cranio-facialis < 11 mm; SG absent or very slightly developed; processus supraorbitalis of lacrimal mostly small. – Fig. 34..... ***Aythya fuligula***

– TL > 89 mm; width of fissura cranio-facialis > 11 mm; SG usually conspicuous; processus supraorbitalis of lacrimal mostly elongated. – Fig. 35..... ***Aythya marila***

29 TL < 90 mm. **30**

– TL > 90 mm. **32**

30 CW > 22 mm, CH > 21 mm; processus supraorbitalis of lacrimal distinct. – Fig. 24..... ***Anas penelope***

– CW < 22 mm, CH < 21 mm; processus supraorbitalis of lacrimal short. **31**

31 Upper bill slightly diverging; maximum upper bill width 13.6–16.3 mm. – Fig. 29..... ***Anas querquedula***

– Upper bill edges parallel; maximum upper bill width 12.3–13.6 mm. – Fig. 26..... ***Anas crecca***

32 Bill extremely widened rostrally; maximum bill width 27–33 mm. – Fig. 30..... ***Anas clypeata***

– Bill edges at most slightly divergent; maximum bill width < 25 mm. **33**

33 CH < 22.5 mm; rostral ventral edge of lacrimal and processus orbitalis meet at a distinct angle (ca. 100°, see arrow in Fig. 6a). – Fig. 25..... ***Anas stepera***

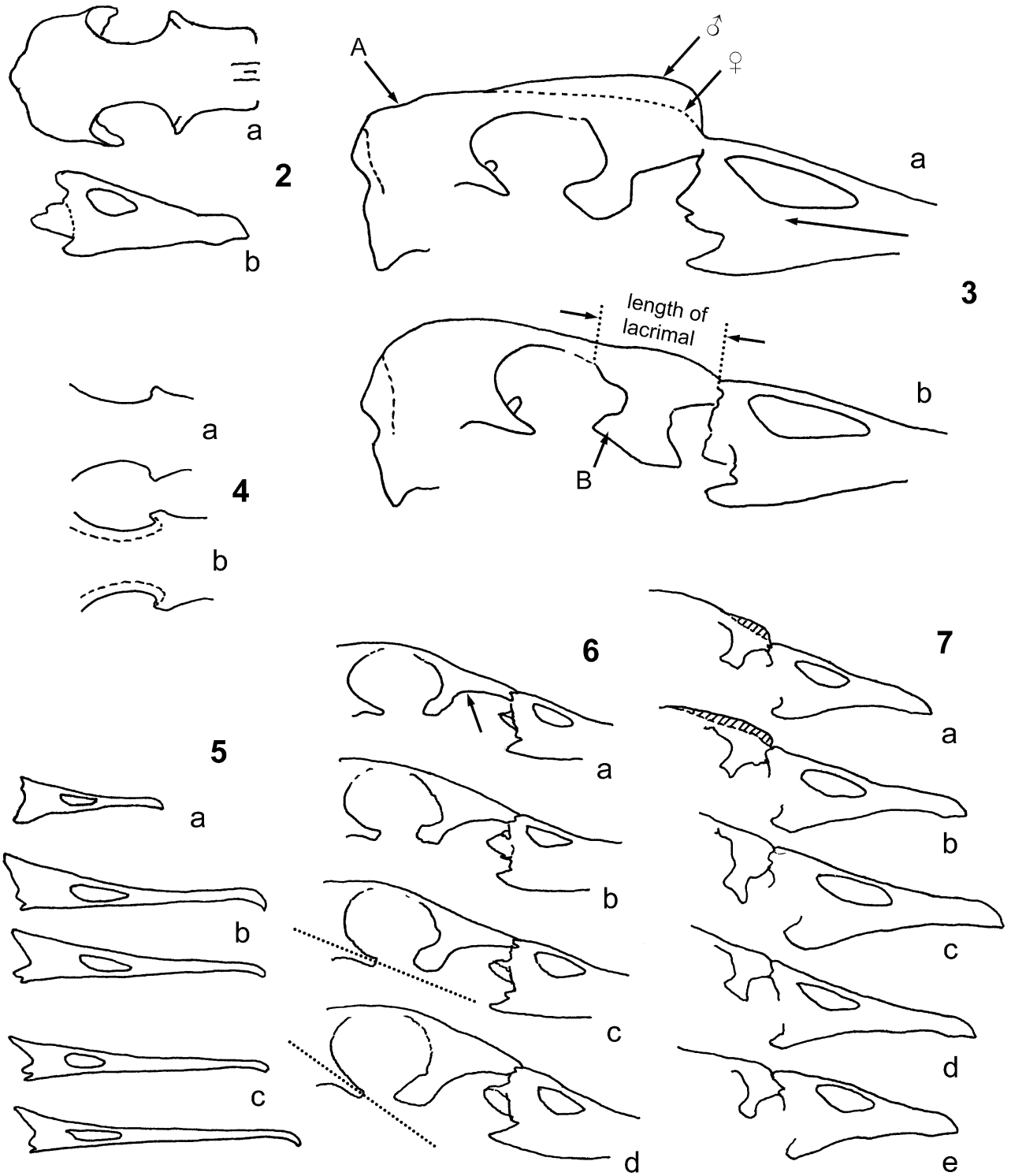
– CH > 22.5 mm; rostral ventral edge of lacrimal and processus orbitalis meet in a slight curve (Fig. 6b–e)..... **34**

34 Dorsal contour of lacrimal slightly convex in lateral view; longitudinal axis of processus postorbitalis directed below the posterior extension of the tomium (Fig. 6d); PL < 31 mm. – Fig. 21..... ***Tadorna ferruginea***

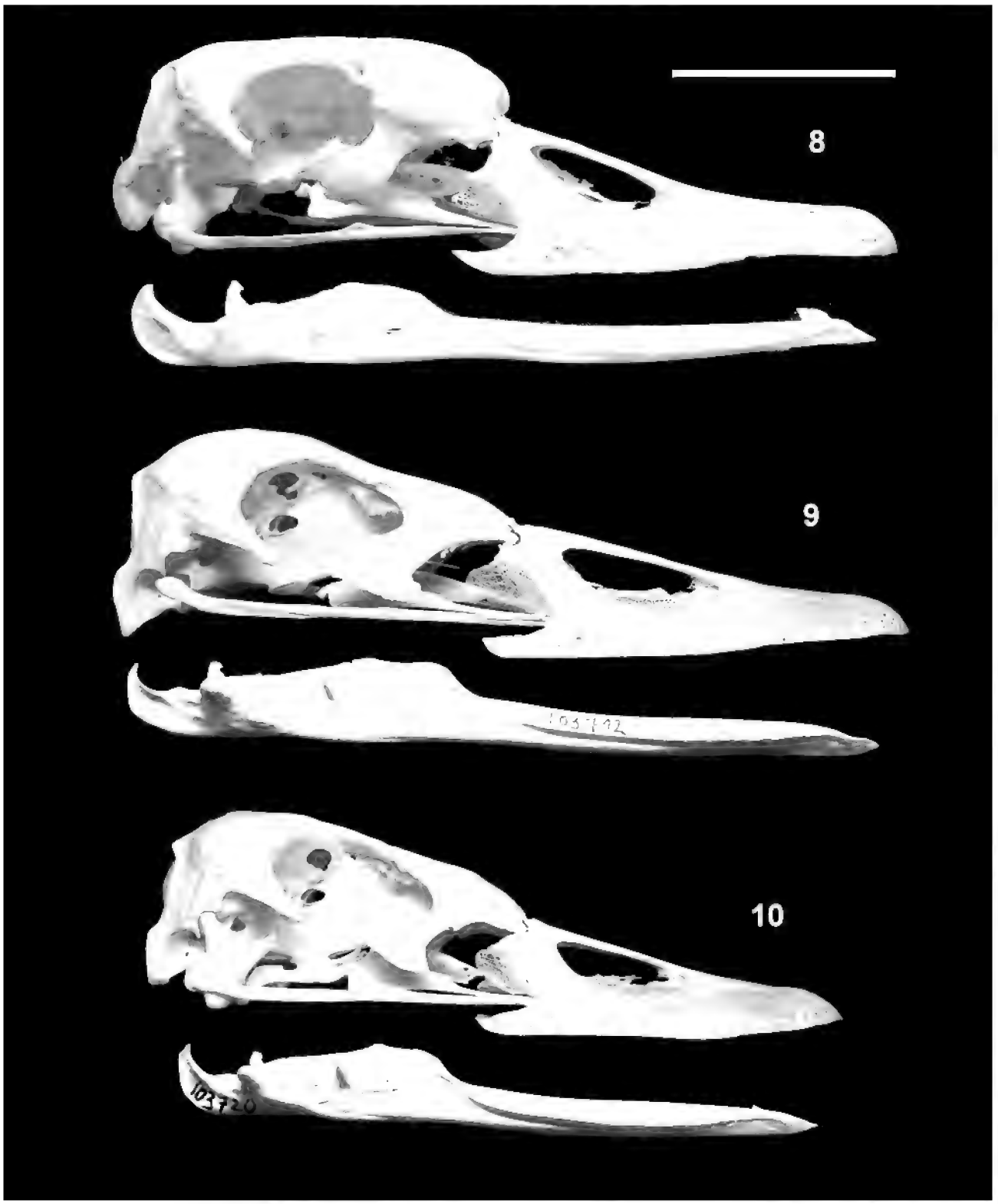
– Dorsal contour of lacrimal straight or protruding only posteriorly in lateral view; processus postorbitalis projects more caudally towards the posterior extension of the tomium (Fig. 6c); PL > 31 mm..... **35**

35 BWUB > 18 mm; dorsal contour of lacrimal straight in lateral view (Fig. 6c). – Fig. 27..... ***Anas platyrhynchos***

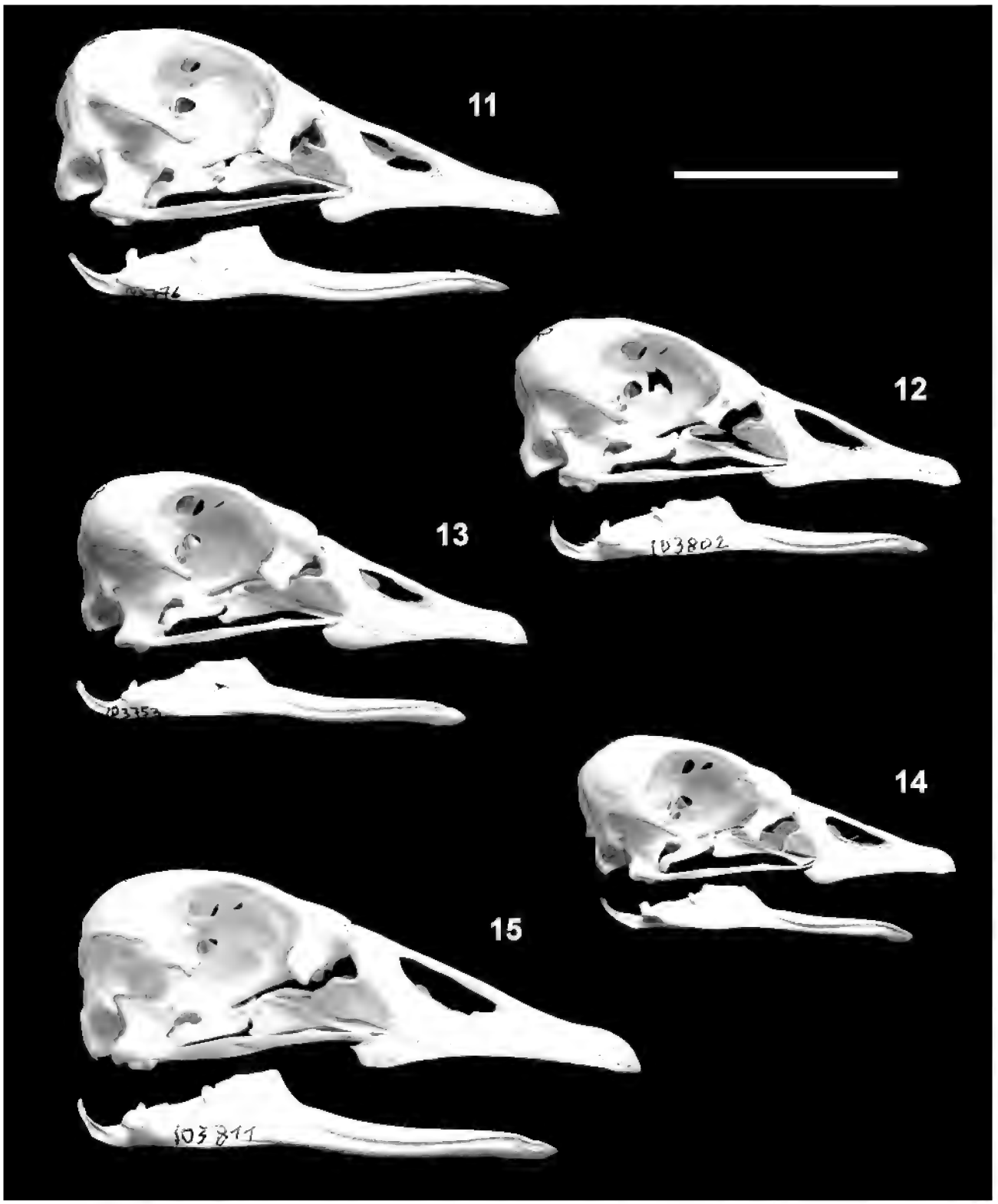
– BWUB < 18 mm; dorsal contour of lacrimal slightly convex in lateral view (Fig. 6b). – Fig. 28..... ***Anas acuta***



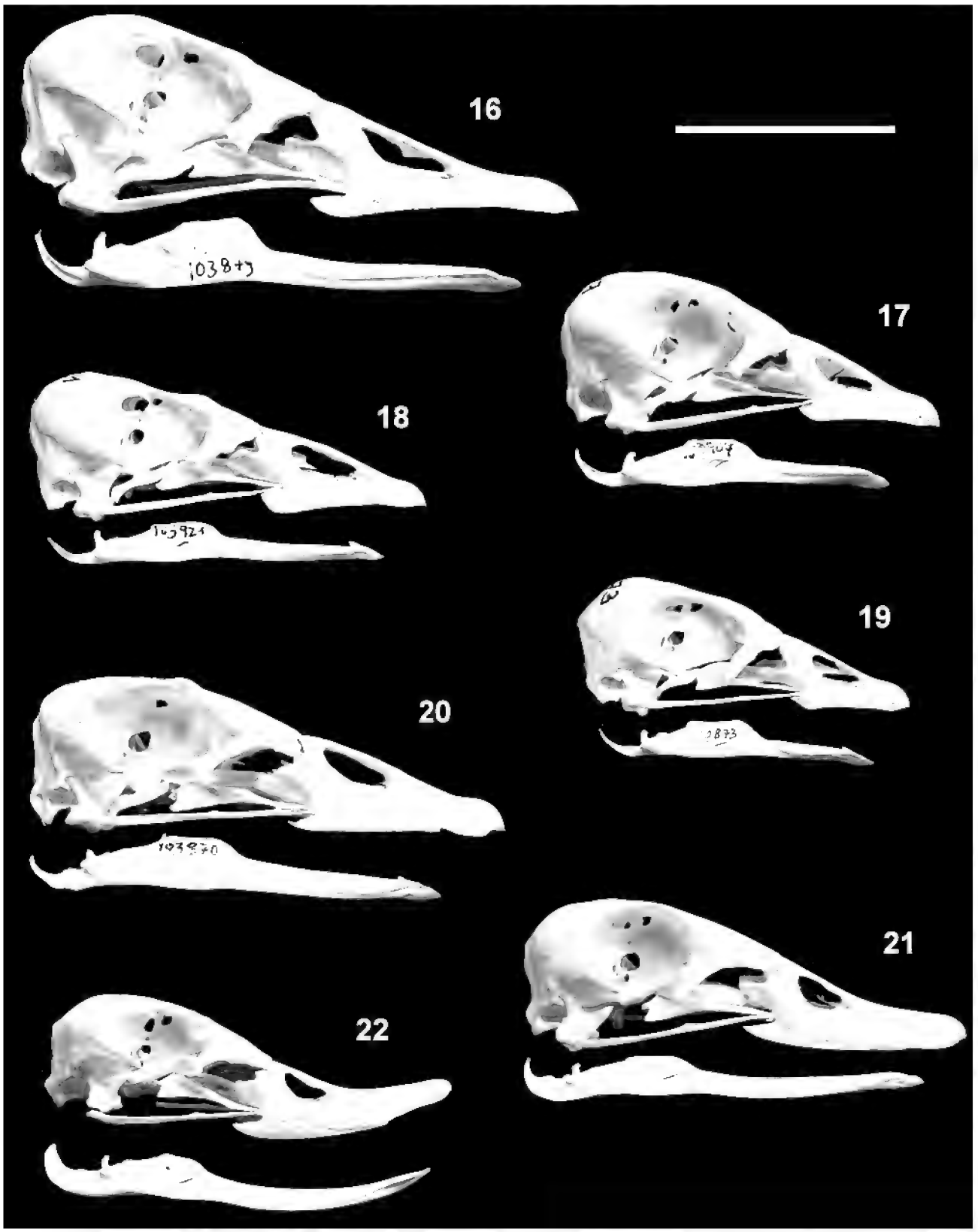
Figs. 2–7. Details of skulls of Anseriformes. – **2**. *Alopochen aegyptiaca*, (a) cranium in dorsal view, (b) upper bill. **3**. Cranium and basal part of upper bill of (a) *Cygnus olor* and (b) *C. cygnus* [A = transverse depression, B = rostral extension of processus orbitalis]. **4**. Interorbital isthmus, (a) without (*Anser*) and (b) with (*Branta*) salt gland fossa. **5**. Upper bills of (a) *Mergellus albellus*, (b) *Mergus merganser* (with variation), (c) *M. serrator* (with variation). **6**. Lacrimal region of (a) *Anas stepera*, (b) *A. acuta*, (c) *A. platyrhynchos*, (d) *Tadorna ferruginea*. **7**. Upper bill of (a) *Anser erythropus*, (b) *A. albifrons*, (c) *A. anser*, (d) *A. fabalis*, (e) *A. brachyrhynchus*.



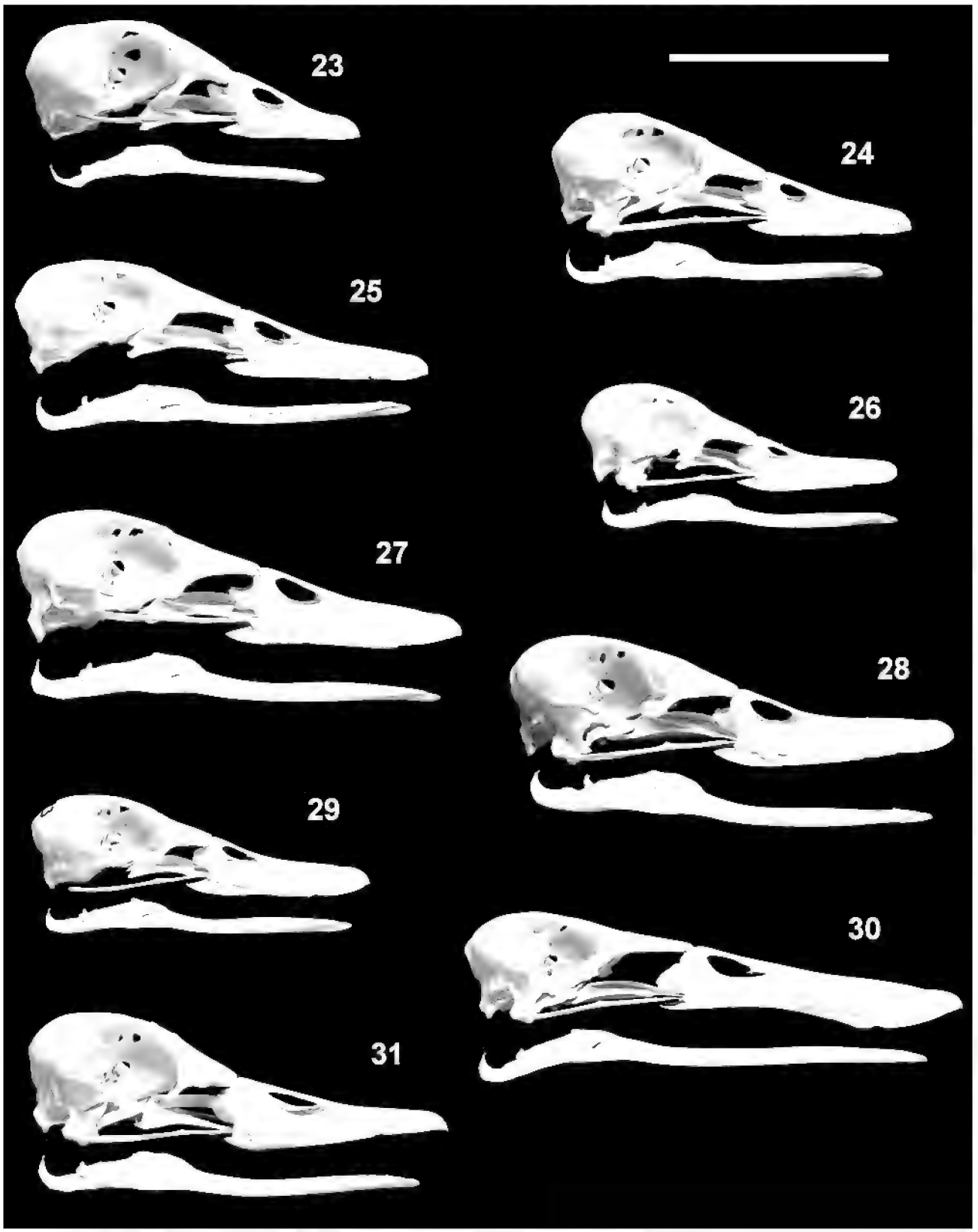
Figs. 8–10. Skulls of Anseriformes, lateral view. – **8**. *Cygnus olor*. **9**. *C. cygnus*. **10**. *C. bewickii*. – Scale: 5 cm.



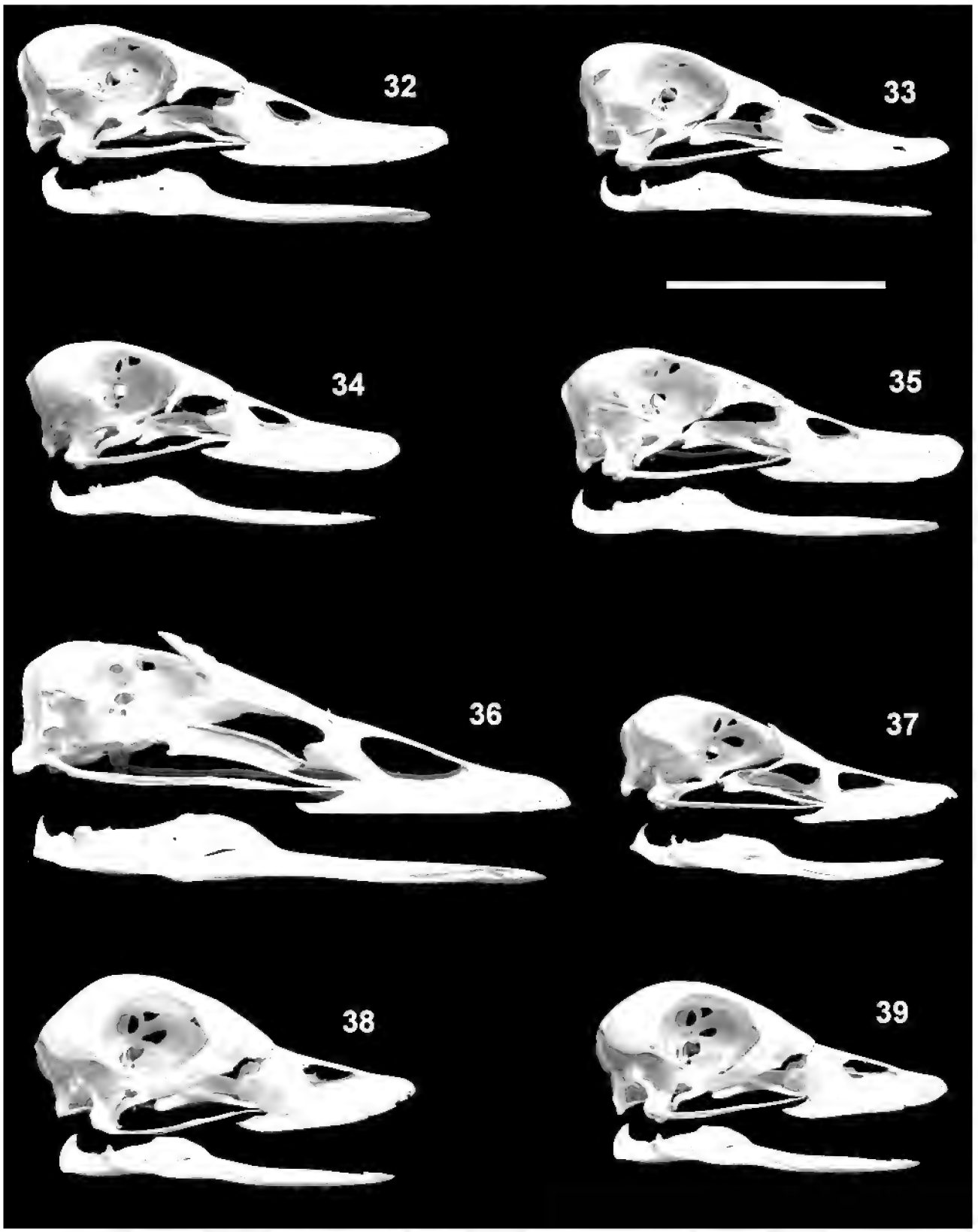
Figs. 11–15. Skulls of Anseriformes, lateral view. – **11**. *Anser fabalis*. **12**. *A. brachyrhynchus*. **13**. *A. albifrons*. **14**. *A. erythropus*. **15**. *A. anser*. – Scale: 5 cm.



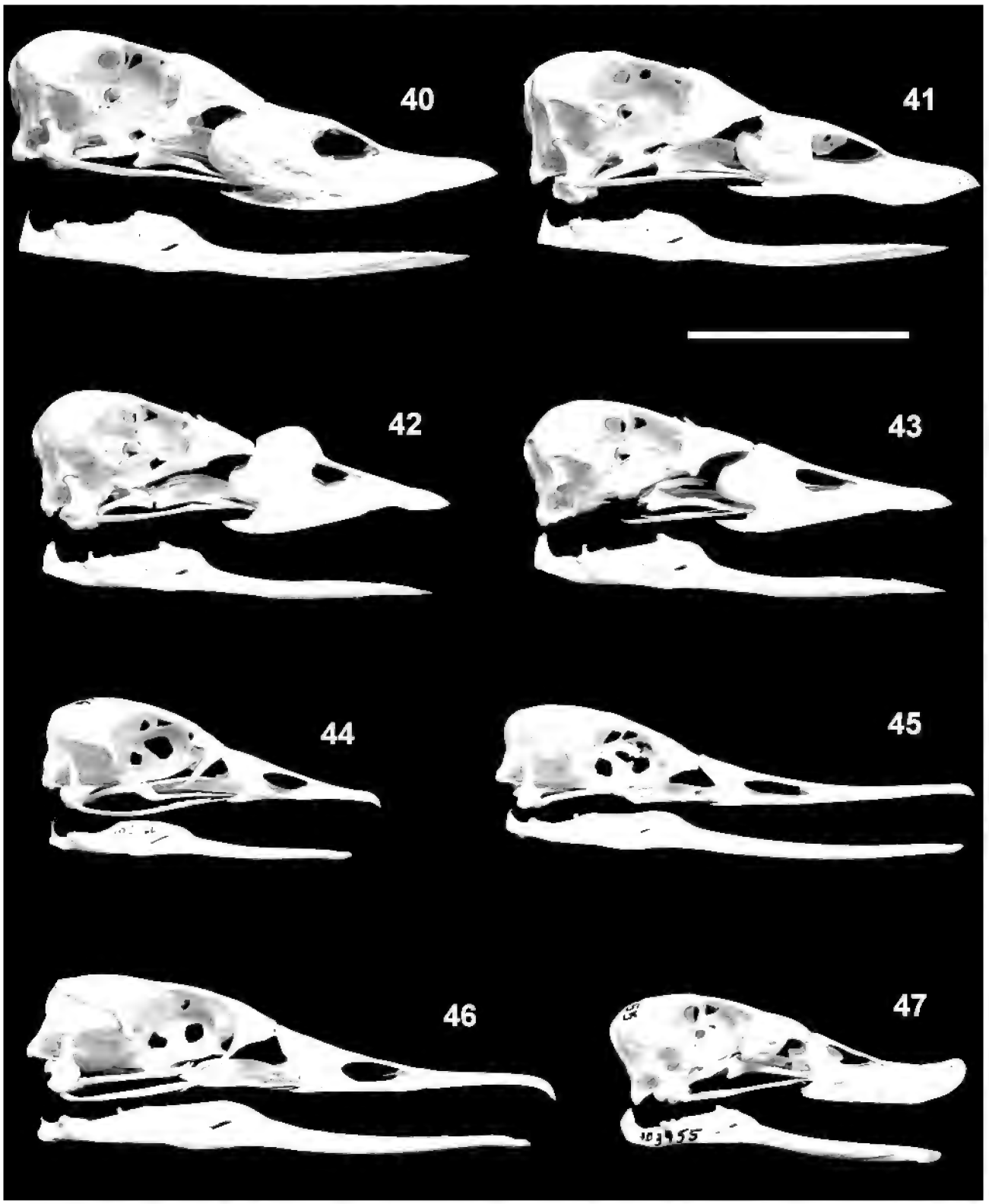
Figs. 16–22. Skulls of Anseriformes, lateral view. – **16**. *Branta canadensis*. **17**. *B. leucopsis*. **18**. *B. bernicla*. **19**. *B. ruficollis*. **20**. *Alopochen aegyptiaca*. **21**. *Tadorna ferruginea*. **22**. *T. tadorna*. – Scale: 5 cm.



Figs. 23–31. Skulls of Anseriformes, lateral view. – **23**. *Aix galericulata*. **24**. *Anas penelope*. **25**. *A. stepera*. **26**. *A. crecca*. **27**. *A. platyrhynchos*. **28**. *A. acuta*. **29**. *A. querquedula*. **30**. *A. clypeata*. **31**. *Netta rufina*. – Scale: 5 cm.



Figs. 32–39. Skulls of Anseriformes, lateral view. – **32**. *Aythya ferina*. **33**. *A. nyroca*. **34**. *A. fuligula*. **35**. *A. marila*. **36**. *Somateria mollissima*. **37**. *Clangula hyemalis*. **38**. *Bucephala clangula* ♂. **39**. *B. clangula* ♀. – Scale: 5 cm.



Figs. 40–47. Skulls of Anseriformes, lateral view. – **40**. *Melanitta fusca* ♂. **41**. *M. fusca* ♀. **42**. *M. nigra* ♂. **43**. *M. nigra* ♀. **44**. *Mergellus albellus*. **45**. *Mergus serrator*. **46**. *M. merganser*. **47**. *Oxyura jamaicensis*. – Scale: 5 cm.

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Observations on fertile populations of *Lunularia cruciata* (L.) Dumort. ex Lindb. (Marchantiopsida: Lunulariaceae) in Germany

Roland Kirschner, Martin Nebel & Theodor Butterfass

Abstract

Sporophytes of *Lunularia cruciata* have been recorded in Germany for the first time. All developmental stages were observed outdoors in the botanical garden of the University of Frankfurt am Main; they are illustrated by photographs in this paper. Within a vegetation period, antheridial receptacles developed in early spring, and were followed by archegonial receptacles in spring and finally by sporophytes in late summer. The observed sequence of development is compared to that reported for other regions. The actual distribution of *Lunularia* in Germany, considering fertile populations, is shown and the ecology is briefly described.

K e y w o r d s : Distribution, fertile populations, *Lunularia*, sporophytes.

Zusammenfassung

Zum ersten Mal werden Sporophyten von *Lunularia cruciata* in Deutschland nachgewiesen. Alle Entwicklungsstadien wurden im Freiland des Botanischen Gartens der Universität Frankfurt am Main beobachtet und für diese Veröffentlichung fotografisch dokumentiert. Innerhalb einer Vegetationsperiode entwickelten sich die Antheridien im frühen, die Archegonien im späteren Frühjahr, die Sporogone folgten dann im Spätsommer. Diese Phänologie wird mit Daten aus anderen Gebieten verglichen. Unter besonderer Berücksichtigung der fertilen Populationen wird eine Karte der aktuellen Verbreitung von *Lunularia* gezeigt. Die ökologischen Ansprüche werden kurz beschrieben.

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1 Introduction

Lunularia Adans. colonies can be easily identified by the half-moon shaped gemma receptacles. Many records of such colonies are known from Africa, America, Asia, Australasia, and Europe. There has been some debate regarding the number of taxa (species, subspecies, formae) within this genus. Specifically it is debated whether *L. cruciata* (L.) Dumort. ex Lindb. (or one of its respective infraspecific equivalents) is the only taxon, or whether *L. thaxteri* A. Evans & Herzog (or one of its respective infraspecific equivalents) is a taxon of this genus found in the Southern Hemisphere (Schuster 1992). Culture experiments showed that the morphological differences used for segregating *L. thaxteri* as a separate species are not stable and of no taxonomic significance (Srivastava 1967, Boisselier-Dubayle et al. 1995 and references given therein). Colonies of different geographic origins (France, Portugal, Spain, South Africa), including a specimen that corresponds morphologically to *L. thaxteri* from Madeira, showed no significant genetic variation with respect to isozymes, and *L. thaxteri* and its respective infraspecific equivalents were all reduced to synonyms of *L. cruciata* (L.) Dumort. ex Lindb. (Boisselier-Dubayle et al. 1995). Molecular studies in the phylogeny of Marchantiophyta show *Lunularia* as a basal lineage of the complex thalloid liverworts (Marchantiopsida). The unique systematic position of *L. cruciata* led to the proposal of the new monotypic order Lunulariales D. G. Long (Long 2006).

Though *L. cruciata* is widely distributed and common, records on sexual reproduction and development of sporophytes of this dioecious species are rare and scattered over continents (Saxton 1930, Boisselier-Dubayle et al. 1995).

A hypothesis involving the assumed influence of symbiotic fungi in the rare sexual reproduction of *L. cruciata* was refuted after closer examination (Nicolas 1929, Auret 1930, Benson-Evans & Hughes 1955). Fungi have,

nevertheless, the potential to form saprotrophic or symbiotic interactions with *L. cruciata* (Nicolas 1929, Fonseca et al. 2006). The rarity of sporophyte development has been attributed to a disjunctive distribution of archegonial and antheridial clones, which itself is caused by mainly anthropogenic spreading (Goodman 1956).

The species is considered native to the Mediterranean region (Frahm 1973, Paton 1999), where sexual reproduction in plants occurs more frequently than in other regions (Sérgio & Viana 1973, Schuster 1992). Sexual reproduction is, therefore, probably triggered by climatic conditions, such as day length (long day conditions) and temperature regimes (rise of temperature after mild winters), but experimental evidence is incomplete (Benson-Evans & Hughes 1955, Perold 1995).

Antheridial and archegonial stages of *L. cruciata* were recorded in the Netherlands where thalli with sporophytes were found in 1873 and 1882 (Gradstein & van Melick 1996). Sporophytes were also recorded in Austria during the second half of the 19th century (Leitgeb 1881). Other records of sporophytes in Europe originated from areas with favourable climatic conditions, e. g. France (Frémy 1925, Nicolas 1929), Italy (Micheli 1729), Spain (Casares-Gil 1919, Schuster 1992), and the south of England and Wales (Goodman 1956, Paton 1999). Outside Europe sporophytes have been found in South Africa (Saxton 1930, Perold 1995), Argentina (Schuster 1992), California (Schuster 1992), India (Naidu 1969), Japan (Shimamura & Deguchi 2002) and New Zealand (Schuster 1992).

L. cruciata was recorded in Germany for the first time in 1828 by Alexander Braun in the botanical garden of Karlsruhe (Frahm 1973). *L. cruciata* was also recorded in 1838 within the botanical garden of Frankfurt am Main (Nees von Esenbeck 1838), which, however, is not situated in the same place today. The liverwort appears to spread from greenhouses and gardens by human activities and is dispersed along flowing water, especially downstream of larger settlements as a result of the influence of sewage and drainage water, and along railways. *L. cruciata* will establish stable populations in shady, moist places without severe winter frosts and competitive vegetation (Frahm 1973, Loos 1991, Tremp & Vulpus 1997). Several authors have stated that only female thalli exist in Germany (Müller 1954, Düll 1980, Frahm & Frey 2004). Nees von Esenbeck (1838) reported a frequent occurrence of archegonial receptacles from Germany, but antheridial ones were only found in the botanical gardens of Bonn. Thalli bearing archegonial receptacles are very rare in Germany (Frahm 2006). Recently (in 2002), however, antheridial receptacles of *L. cruciata* were discovered at the botanical gardens of Tübingen (Schoepe 2005). Until now, sporophytes were absent in this country.

The ecology of *Lunularia* in Central Europe (Tremp & Vulpus 1997, Schoepe 2005) is closely related to that in Great Britain (Paton 1999). The spreading of *Lunularia* outdoors in Germany over the years has been well recorded in distribution maps (Frahm 1973, Düll & Meinunger 1989, Meinunger & Schröder 2007).

Acknowledgements

We thank J.-P. Frahm (Bonn) for helpful discussion of the antheridial stage of *L. cruciata*, the curators A.-M. Lenk and M. Wessel of the botanical garden in Frankfurt am Main for their generosity towards our studies in the garden, M. Preussing (Holzminden) for providing information on locations of fertile *Lunularia*, O. Dürhammer (Regensburg) for generating the distribution map and for kindly providing data, and the referees for their valuable comments and suggestions.

2 Material and Methods

The observed colony of *L. cruciata* covered an area of approximately 1.0 × 0.5 m originally planted with *Mentha* and *Urtica* species at the border of the botanical garden of the Goethe University of Frankfurt am Main. The site was shadowed by trees to the southwest and exposed to light only from the northeast. The soil contained loam and humus in the uppermost layer, becoming loamier in the deeper layers and had not been used for plant cultivation for approximately two years prior to the observation of *L. cruciata* (A.-M. Lenk, pers. comm.). In the spring of 2008, *L. cruciata* was the dominant plant in this area. The colony was observed between 21 February and 8 September 2008.

Fertile specimens of *L. cruciata* have been deposited in the Herbaria of FR and STU.

The nomenclature follows Koperski et al. (2000) in liverworts, Szweykowski et al. (2005) in *Conocephalum* and Hill et al. (2006) in mosses.

The abbreviations (e. g. "4122 SO") in chapter 3 refer to the German ordinance survey maps with a scale of 1 : 25000.

Acronyms of depositories

FR	Herbarium Senckenbergianum, Forschungsinstitut Senckenberg, Frankfurt am Main, Germany
STU	Herbarium Staatliches Museum für Naturkunde, Stuttgart, Germany

3 Distribution of *Lunularia cruciata* in Germany

Sterile plants
(Fig. 1)

Lunularia cruciata is widespread in Germany. Centres of distribution are the city states of Berlin, Hamburg and Bremen. In Schleswig Holstein, the species occurs mainly in the eastern parts along the Baltic Sea; in Niedersachsen in the southern parts; in Nordrhein-Westfalen in the western parts and along the river Rhein; in Hessen in the southern and north-eastern parts; in Baden-Württemberg in the northern parts, mainly along the river Neckar; in Rheinland-Pfalz, Saarland and Sachsen it is scattered over the whole area; and in Bayern, it is found only in the north-central region.

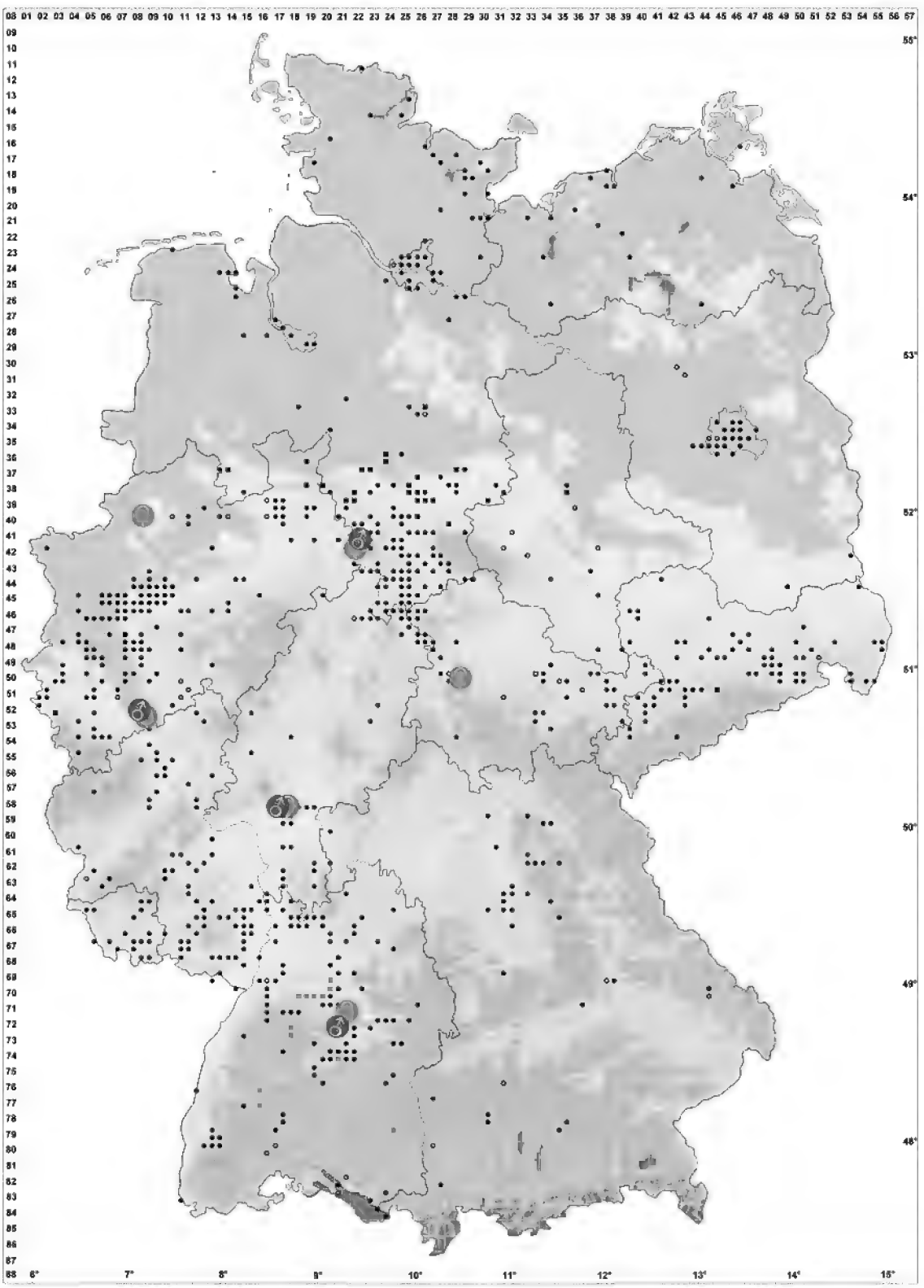
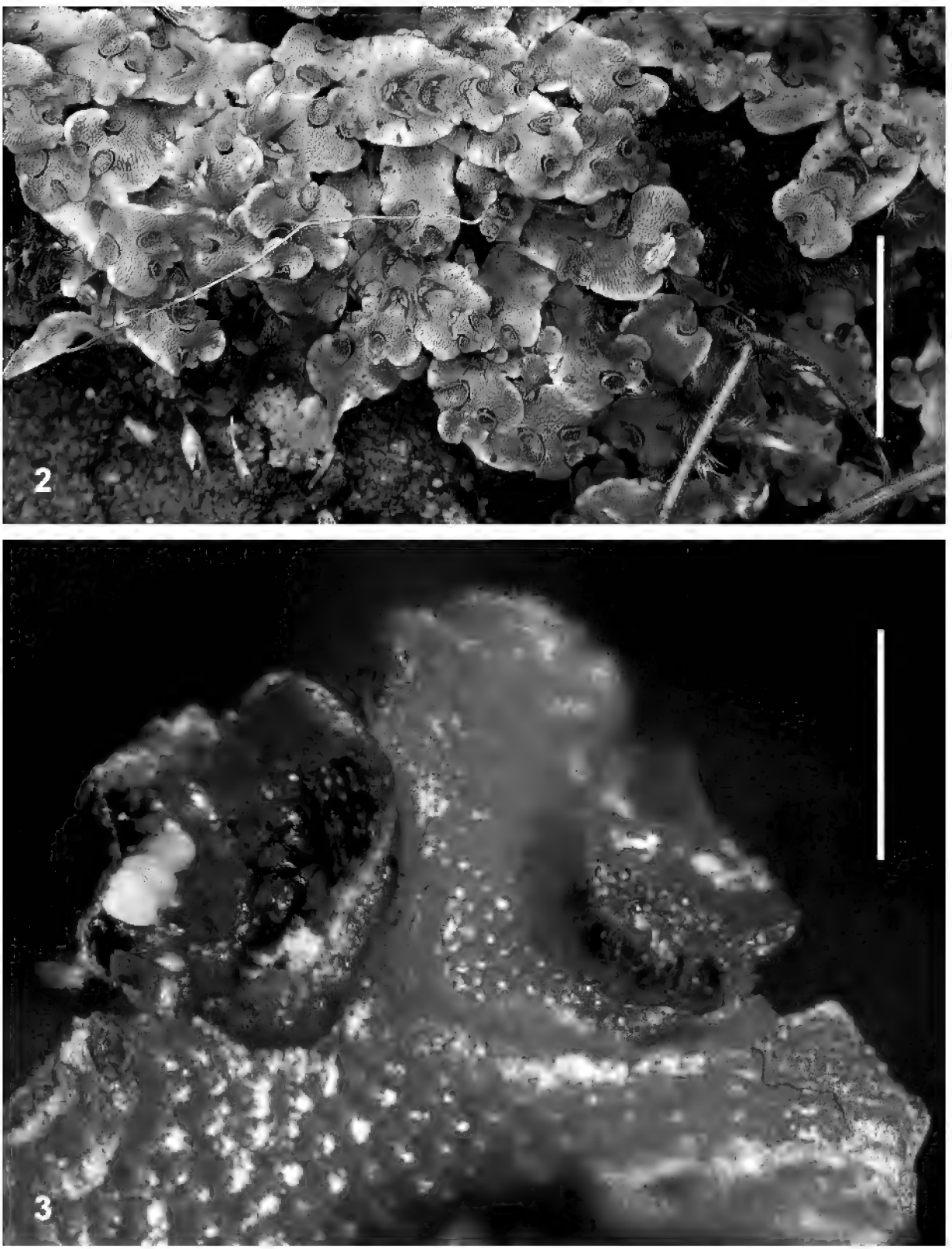
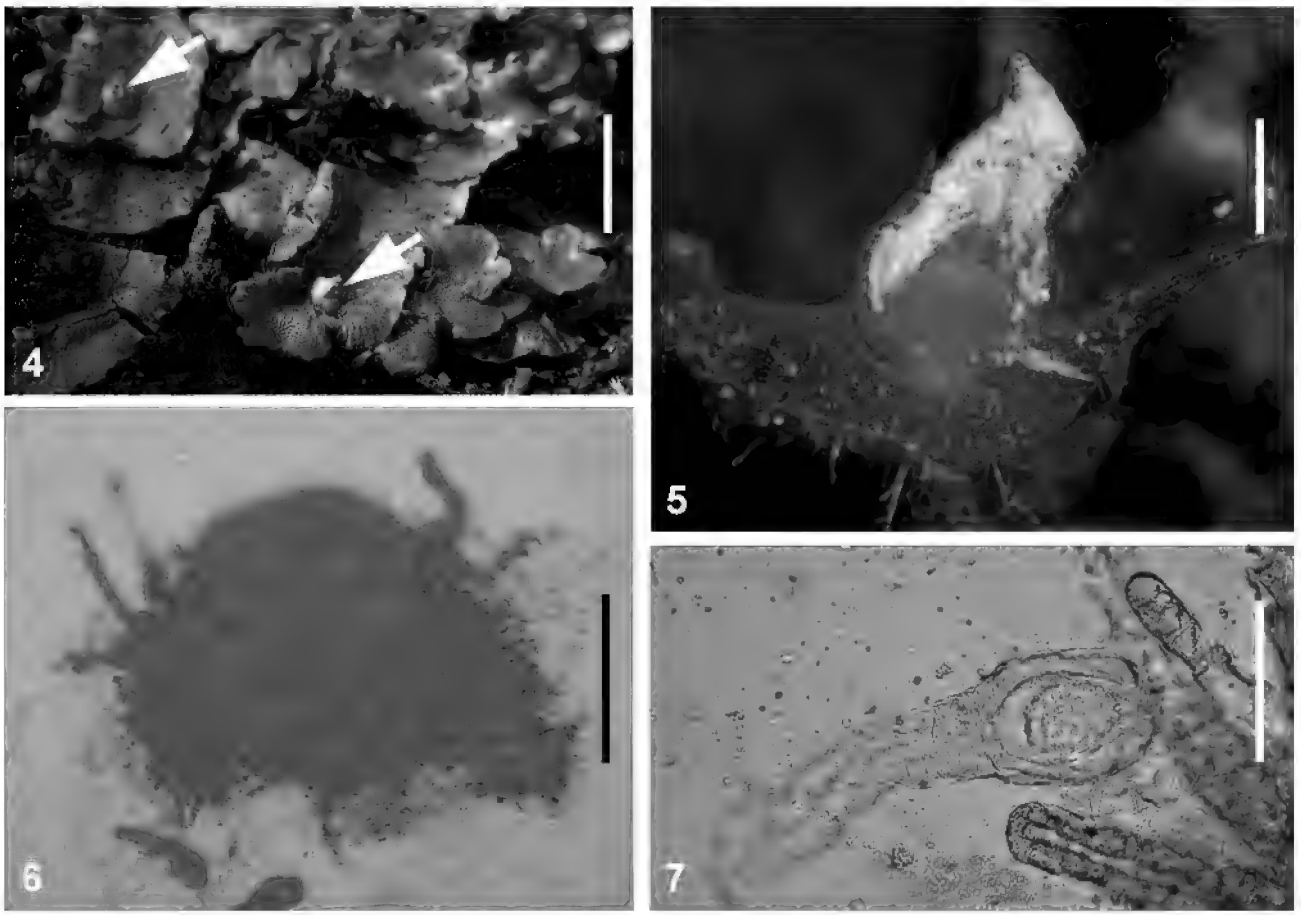


Fig. 1. Distribution of *Lunularia cruciata* in Germany, sterile [small black squares (herbarium specimens) and circles 1980 and later, open black squares (herbarium specimens) and circles before 1980, small red squares in addition to Meinunger & Schröder 2007], fertile male (large blue dots) and fertile female (large red dots) populations. – Base map by H. Blatt (Friedberg); map composition: Zentralstelle Deutschland (www.moose-deutschland.de).



Figs. 2–3. Antheridial receptacles of *Lunularia cruciata*. – **2**. Male thalli with antheridial receptacles and half-moon shaped gemma receptacles. **3**. Two antheridial receptacles, the epidermis of the left one lifted in order to expose the ellipsoidal antheridia filled with white masses of spermatozoids. – Scales: 10 mm (2), 1 mm (3).



Figs. 4–7. Archegonial receptacles of *Lunularia cruciata*. – **4**. Female thalli with archegonial receptacles (arrows). **5**. Longitudinal cross-section through an archegonial receptacle. **6**. Archegonial receptacle with mature basilateral archegonia (stained with cotton blue) seen with the light microscope. **7**. Mature archegonium. – Scales: 5 mm (4), 1 mm (5), 200 µm (6), 50 µm (7).

Since the publication of the first distribution maps by Frahm (1973) and Düll & Meinunger (1989), *L. cruciata* has obviously spread. Whereas, in the past, most of the populations occurred in the western area, the species can now also be found regularly in the eastern parts of Germany. *L. cruciata* prefers lower elevations, the valleys of large rivers and urban areas. Above 500 m altitude, it becomes rare. In the south of Germany, it reaches 630 m altitude in the Neckar valley east of Dauchingen (Schoepe 2005).

The mapping of the distribution of sterile plants is mainly based on data from Meinunger & Schröder (2007).

Records of male plants
(Fig. 1)

4122 SO: Holzminden, Stadtpark, Thomaskirchweg, lehmige Erdböschung [= loamy soil-slope], 120 m, 25.III.2009, M. Preussing (STU).

5208 SO: Bonn, Poppelsdorf, Botanischer Garten [= botanical garden], Nees von Esenbeck (1838).

5817 SO: Frankfurt, Botanischer Garten [= botanical garden], 21.II.2008, R. Kirschner (FR, STU).

7421 SW: Tübingen, Botanischer Garten [= botanical garden], Farntälchen, 430 m, X.2002 and 12.I.2005, M. Nebel, M. Preussing (STU).

Records of female plants
(Fig. 1)

4008 NO: Sierksfeld 3 km NE Coesfeld, end of March/beginning of April 1957–1966, Neu (1967).

4222 NW: Höxter, Corbiestraße 5, Mauer am [= along a wall] Grube-Bach, Spritzwasserbereich [= spray zone], 100 m, 5.III.2009, M. Preussing (STU).

5208 SO: Bonn, Poppelsdorf, Botanischer Garten [= botanical garden], Gewächshaus [greenhouse], 2005, Frahm (2006).

5817 SO: Frankfurt, Botanischer Garten [= botanical garden], 2.V.2008, R. Kirschner (FR, STU).

7121 SO: Waiblingen, Remsaue [= floodplain of the river Rems], Steinschüttung am Ufer [= rock fill along a riverbank], 220 m, 12.IV.2009, M. Nebel (STU).

Record of sporophytes
(Figs. 8–13)

5817 SO: Frankfurt, Botanischer Garten [= botanical garden], 23.VII.2008, T. Butterfass (FR).

4 Ecology of *Lunularia cruciata*

L. cruciata is a nutrient indicator found in moist to wet (sometimes flooded), alkaline, eutrophic to highly eutrophic, shaded habitats that are often disturbed. It is frost sensitive.

The species is distributed mainly on banks along rivers with little fluctuation of water level; on loam, alluvial loam and alluvial loam-covered stones, boulders and concrete; on steep loamy slopes, on exposed tree roots and soil-covered logs. As well as being found alongside flowing freshwater it appears as a horticultural weed in and around glasshouses, in gardens and parks, in churchyards, sometimes also on railway stations (Loos 1991) growing on moist soil in the shadow of walls and in gaps between sidewalk flagstones. It is usually associated with the following liverworts and mosses: *Marchantia polymorpha* ssp. *ruderalis*, *M. polymorpha* ssp. *polymorpha*, *Pellia endiviifolia*, *Conocephalum conicum*, *C. salebrosum*, *Platyhypnidium riparioides*, *Cratoneuron filicinum*, *Brachythecium rutabulum*, *B. rivulare* and *Oxyrrhynchium hians*.

In Central Europe *L. cruciata* grows under ecological conditions that are close to those described for the British Isles (Paton 1999). In Germany, it was originally only found in greenhouses and botanical gardens, but it since has established itself primarily on banks of nutrient rich rivers in locations with mild winters. Most populations are located in a small belt near the water, because a great amount of the gemmae are washed ashore here. The frost decreasing effect of water spray in this habitat is also important. Even after frosty periods with ground temperatures from –20 °C, vital thalli can be found here. Tremp & Vulpus (1997) observed prospering populations of *L. cruciata* on riverbanks downstream from or below sewage works.

5 Observations on fertile populations of *Lunularia cruciata*

Boat-shaped, purplish antheridial receptacles (Fig. 2) were discovered on 21 February 2008. After detaching the covering epidermis of antheridial receptacles, ellipsoidal white antheridia arranged in two rows (Fig. 3) could be detected. In the light microscope, the antheridia were found to be immersed in the receptacles containing densely packed masses of spermatozoids. On 2 May, many thalli with conspicuous white, scaly, nipple-shaped archegonial receptacles (Figs. 4, 5) were intermingled with antheridial thalli. Mature archegonia developed laterally at the base of a stout column covered by white imbricate scales (Figs. 6, 7). During summer, herbaceous plants developed between the thalli and became dominant. In the first week of July, no sporophytes were observed, but on 23 July and during August, sporophytes at all stages of development occurred along with archegonial receptacles that apparently had ceased to develop, probably because of ineffective development of archegonia or lack of fertilisation by spermatozoids. The column enclosed by the imbricate scales of the archegonial receptacle elongated considerably, exposing its apex, which became campanulate (Fig. 8). Eventually after maturation, 1–3 sporophytes became apically exposed from each of the four finger-like involucral arms (Figs. 9–11). The sporophyte was composed of a seta and a capsule that opened with four valves, and exposed spores and bispiral elaters (Figs. 12, 13). Sporophytes were not found on 8 September 2008.

In another, smaller population of *L. cruciata* in the botanical garden of Frankfurt, represented by a few thalli covering only few square centimetres shaded by a mugo pine in the alpine garden, only gemma receptacles were found during the whole observation period.

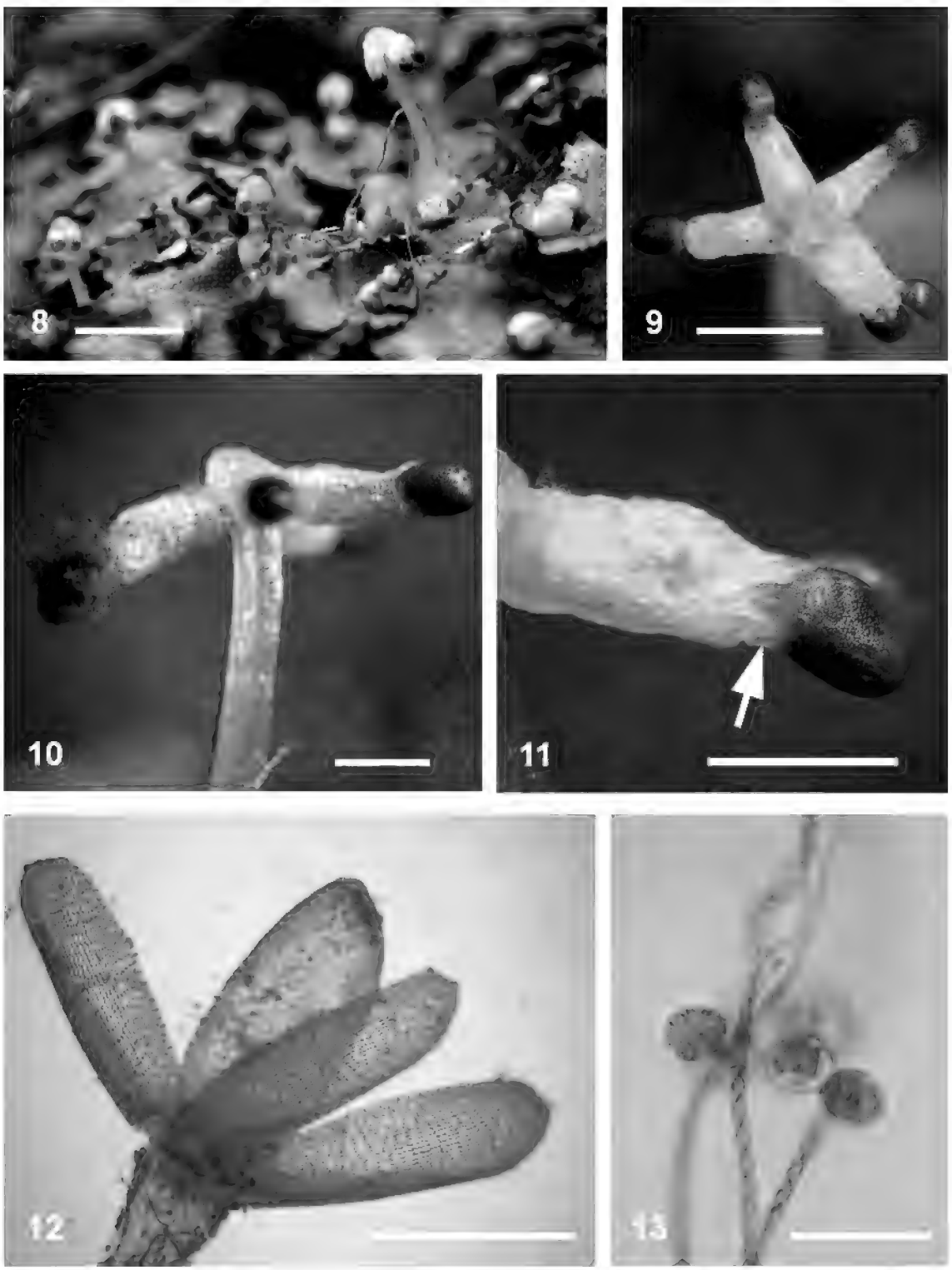
6 Discussion

Morphology

The studied morphology confirms the results of previous contributions. Cellular details of antheridial and archegonial receptacles were illustrated by Saxton (1930), Benson-Evans & Hughes (1955) and Paton (1999). Sporophytes were first described and illustrated by Micheli (1729). Cellular details of sporophytes were illustrated as seen with the light microscope by Saxton (1930), by transmission electron microscopy by Shimamura & Deguchi (2002), and by scanning electron microscopy of spores and elaters by Perold (1995). Colour photos of all developmental stages (Figs. 2–13) are provided for the first time in this paper.

Phenology

The periods of antheridial and sporophyte development in February and July–August, respectively, correspond to the periods recorded from France (Nicolas 1929), Portugal (Sérgio & Viana 1973), and South Wales (Benson-Evans & Hughes 1955). Nees von Esenbeck (1838) recorded antheridia for a German specimen collected in March. These periods do not agree with the season of sporophyte development given as January to March in Spain by Schuster (1992), who assumed a genetic basis for such phenological differences. Sérgio & Viana (1973), however, who investigated 8–46 populations of *L. cruciata* in each of the four seasons in Portugal, found that antheridial, archegonial and



Figs. 8–13. Sporophytes of *Lunularia cruciata*. – **8**. Thalli with sporophytes at different stages of development. **9**. Sporophytes extending from four involucral arms seen from above. **10**. Sporophytes extending from involucral arms in lateral view, with the capsule at the left opened and exposing elaters and spores. **11**. A single sporophyte with spore capsule and apex of seta (arrow) separated from the involucral arm in lateral view. **12**. Valves of an opened, emptied spore capsule (mounted in 5 % aqueous KOH solution) seen with the light microscope. **13**. Elaters and spores seen with the light microscope (5 % KOH). – Scales: 5 mm (8), 2 mm (9), 1 mm (10), 500 µm (11, 12), 50 µm (13).

sporophytic stages can be formed in every season of the year, but with antheridial stages being predominant in winter (January to March), archegonial stages in spring (April to June) and sporophytes in summer (July to September). The sequence of development of antheridia (in February) and archegonia (in May) leading to the development of sporophytes in July–August indicates that different climatic conditions are possibly required for the optimal development of each stage, including initially low temperatures and short day lengths which gradually rise over several months (Benson-Evans & Hughes 1955). In our observations, we found antheridia in mature stages in early spring. According to Benson-Evans & Hughes (1955), the development of antheridial receptacles is initiated in late summer and finishes in the spring of the subsequent year, whereas archegonial receptacles complete their development within a single vegetation period. In contrast to the development of archegonial receptacles that could be induced in the laboratory, antheridial receptacles were not observed in laboratory culture (Benson-Evans & Hughes 1955).

Initiation and maturation of antheridial receptacles apparently require a complex sequence of different environmental conditions. These specific requirements in addition to the distribution of male and female thalli explain the general rarity of sporophyte development outside areas with Mediterranean conditions. We assume that male thalli have not recently immigrated into Central Europe, but were present and unrecognised over the time, which is indicated by the historical records of not only archegonial receptacles, but also antheridial receptacles and/or sporophytes from Austria and Germany (Leitgeb 1881, Nees von Esenbeck 1838). Leitgeb (1881) did not explicitly state the origin of the sporophytes which he described, but wrote that the species was common in "our gardens" (i. e. in Austria, probably in Graz). Nees von Esenbeck (1838) expressly based his detailed description of antheridial and archegonial receptacles on material from Germany (botanical garden of Bonn) and the description of sporophytes on Italian material (J. Raddi's collection), because sporophytes did not develop in Germany. The note about the presence of male and female thalli in the botanical garden of Bonn by Müller (1906–1911) presumably originated from the observation by Nees von Esenbeck (1838), but afterwards became obscure to Müller himself and was omitted from his later publications (Müller 1954).

The recent observations of antheridial receptacles in Tübingen and Frankfurt, and sporophyte development in Frankfurt, might indicate the influence of climatic changes in Germany on phenology. This change could be characterised as tending towards a "Mediterranean-type" as indicated by other records of sporophytes. This observation agrees with the general poleward range-shifting of geographic distribution and phenological changes in plants and animals as a result of climate change (Parmesan et al. 1999, Thomas & Lennon 1999, Walther et al. 2002).

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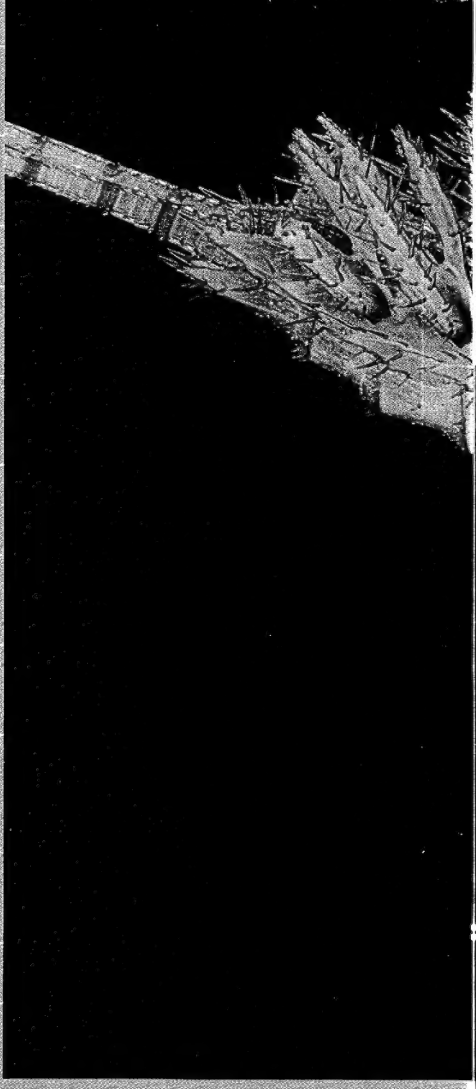

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